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THE ROLLER SKATING TEST OF A SMOOTH PAVEMENT OF CONCRETE.

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Most Englishmen [and Americans] at heart prefer the worst of amateurs to the best of experts, and would rather be wrong with the one than right with the other. They will long persist in that preference and will long cling to the honest belief that the country's greatness is based upon it. —*William Harbutt Dawson.*

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REFUSE DESTRUCTOR AT SAVANNAH, GA.

By E. R. Conant, City Engineer.

The city of Savannah recently completed a high-temperature refuse destructor, which has been operated long enough to give an idea of its efficiency and economy. The author describes also the special features in design and operation, which add to the satisfaction given by the plant. The article is abstracted from a paper before the American Society of Municipal Improvements.

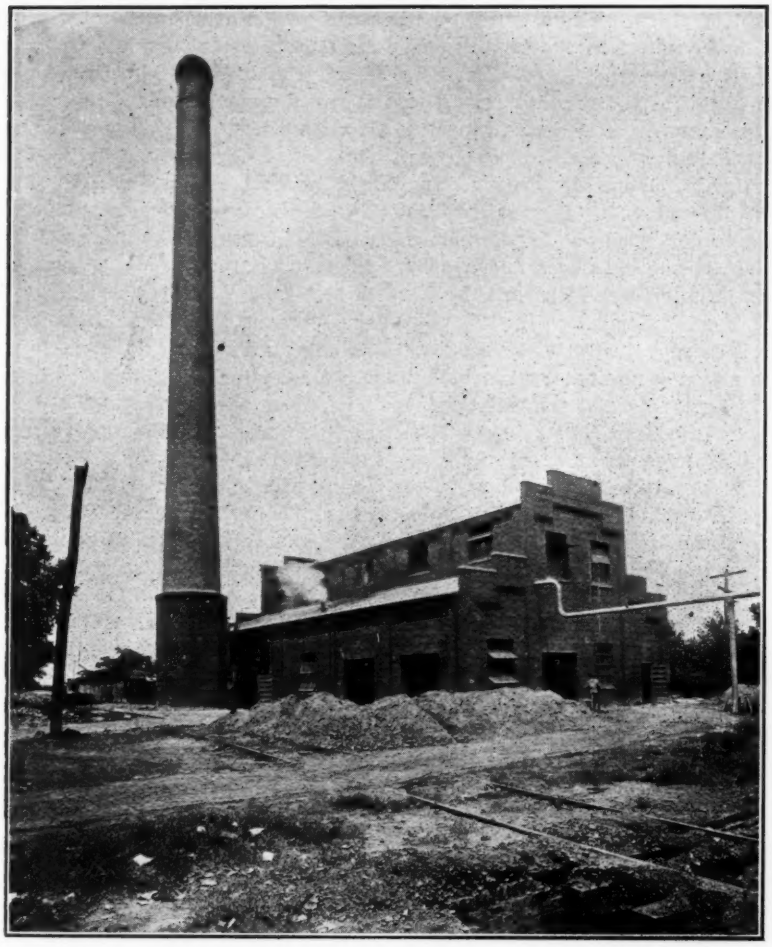
EARLY in 1913 the writer studied the various methods of disposal of garbage and visited several cities where high temperature incinerator and reduction plants were in operation, and, after giving due weight to the various methods, recommended to the city the adoption of a high temperature incinerator plant, which recommendation was approved by the mayor and aldermen, and proposals were asked. After carefully considering the proposals received, a contract was made and entered into in July, 1913, with the Destructor Company of New York for a plant of the Heenan type, with a daily capacity of 130 tons.

The company made two proposals—one to furnish a destructor plant operated wholly mechanically with clinker chamber under the grate, at a cost of $170,000. The other proposal was to furnish a plant of the same general type at a cost of $125,000, with a different method of charging the furnaces and withdrawing the clinkers. With the higher price plant the guaranteed cost of operation was 29.30 cents per ton; with the lower cost plant 40.4 cents per ton. The guaranteed water evaporation for the $170,000 proposal proposal was 1.8 pounds of water to one pound of refuse consumed; for the $125,000 plant it was 1.34 pounds of water to one pound of refuse consumed.

While the guarantees for the higher price plant were inviting, the writer, for good reason, recommended the second or lower price proposal to be adopted by the city, and from results attained it would appear that the selection was the best. In considering the adoption of the high temperature plant, consideration was given to making use of all by-product steam that could be obtained by burning the refuse over that required by the plant for operating the plant to partially operate one of the city's water works pumping stations.

With this in view the plant was located on the city's property and adjacent to the pumping station. The distance between the buildings as constructed is but 60 feet, and the distance between the boilers of the destructor plant and where the steam is delivered to the main steam header in the boiler room of the water works is 140 feet.

In the destructor plant there are two 65-ton capacity per day Heenan type furnaces. Each unit comprises four cells about 28 inches wide on the bottom, 34 inches at the top, 16 inches deep, 8 feet long. Each unit has a separate charge combustion chamber, a 200-horse-power Wickes water-tube boiler and an air heater and cylindrical centrifugal fan for supplying forced draft. The cells are fitted with trough grates, which is a comparatively recent development, but is already quite extensively used in plants constructed by this company and by Heenan-Froude,



SAVANNAH REFUSE DESTRUCTOR. *Large pipe in the right foreground carries steam from destructor boiler to pumping engines of water works plant, thus saving fuel in that plant.*

Ltd., Manchester, Eng., who made the original design. The contract also covers a building to house the plant, a receiving pit of 260 cubic yards capacity for receiving the refuse, a regenerator or preheater, electric hoist for taking the material from the storage pit and transferring it to the containers, necessary instruments for measuring and recording conditions of the furnaces, wagon scale for weighing the refuse, a steam turbo or engine driven generator of 75-k.w. for supplying the necessary current for lighting the plant and operating the motor. The cells were so constructed as to have a burning area over each grate of 20 square feet, each boiler to have a heating surface of 2,000 square feet with a working pressure of 160 pounds per square inch. The stack, of radial brick construction, is 150 feet high and 6½ feet inside diameter at the top. The receiving storage pit as constructed in this plant has advantages over some that have been observed at other plants. It is 32 feet long, 20 feet deep and 11 feet wide. The greatest length is parallel with the beam supporting the crane carrying the hoisting grab bucket, and the bucket can reach any of the material in the pit by direct drop, without extra rehandling in the pit. Then,

again, the bucket can pick up any portion of the refuse dumped in the hopper and distribute it over the surface, if desired, to bring about a better mixture. The combustion chamber is of ample capacity and properly proportioned to receive and thoroly mix and burn all gases coming from the different cells discharging into it. There is ample space for the collection of dust in the chambers and a door to same is large enough to permit the entrance of dead animals.

A superheater, of the Foster type, superheats the steam generated by the boiler. The air heater is located immediately at the rear of the boiler. The supply of air for forced draft is taken from the ventilating system within the building. The containers into which the material is deposited from the grab bucket are arranged one over each cell of the furnaces. Each has a capacity of about one cubic yard and they are closed by horizontal sliding doors built in two parts. Each cell receives charges of about one cubic yard. The space above each grate is common to each cell and to the combustion chamber, so that there is free interchange of heat between cells. The main grates on which the combustion takes place are of heavy cast iron construction. They are perforated with a sufficient number of holes arranged to give proper distribution of air thruout the refuse and at the same time to secure the maximum cooling effect on the iron supports. The clinker car is of special design for receiving clinker as it is withdrawn from the furnaces.

Guarantees Made—The plant shall be capable of destroying in normal operation without adidtional fuel 130 tons of refuse in 24 hours. No odors or obnoxious gases shall escape from the chimney or the building. That at no time during the normal operation of the plant shall the temperature fall below 1,250 degrees F., and that an average temperature of 1,500 degrees F. shall be maintained in the combustion chambers. That the number of pounds of steam generated in the boiler from and at 212 degrees F. per pound of refuse consumed shall not be less than 1.3 pounds per pound of refuse consumed. That the net effective boiler capacity in horse power for steam utilization over

SAVANNAH DESTRUCTOR. *Grab bucket dumping refuse into containers above the furnace cells. These buckets take the refuse from carts and from pile.*

SAVANNAH DESTRUCTOR. *Dumping refuse from wagon and from grab bucket into the hoppers from which the furnaces are fed.*

and above that required for operating the plant will be 330 horse power, based on 34.5 pounds per boiler horse power. The cost per ton for the incineration based upon the schedule of wages to be paid and with force as required and set out in the specification shall not exceed 40.4 cents per pound. Another important guarantee is as to the number of pounds of refuse to be burned per hour per square foot of grate area upon which final combustion takes place. In this plant it is guaranteed not to be less than 68 pounds, which is a reasonable guarantee.

Total Cost of Plant—Some changes were made in the proposal received for the plant, and the contract with the destructor people, excluding the extras, was $120,000. Extras for excavation, concrete foundations, steam line from plant to pumping station, etc., paid contractor were $3,971. Cost of inspection and miscellaneous work done by city forces in connection with the construction of the plant was $2,300, making the total cost of the plant to the city $126,271.

Refuse brought to the plant is first weighed on wagon scales and is then dumped into the storage hopper at the ground level. The refuse is fairly well mixed and from there it is taken from the grab bucket operated by an electric transporter and delivered to the containers that are located over each cell of the furnaces. At the bottom of these containers is a solid door operated by hydraulic power, so arranged as to be convenient to the stoking floor, which enables the stoker to fill his grate in accordance with the requirements of his fire. Stokering is done thru a supplementary door, which avoids the necessity of opening the large door thru which the clinker is withdrawn.

The clinker formed on the grates is removed by semi-mechanical means. The sides of the grates diverge slightly from the rear to the stoking door. There is a large bar to which is fastened a plate which forms an upturned hoe laid on the bottom of the grate before the first charge is dropped upon it, and the clinker is pulled out bodily by power obtained from a hydraulically driven winch onto a hand-pushed car, which is pulled over a level paved surface to the dump. This method of clinkering permits of the clinker being

removed from the grate in from three to four minutes. The platform at the dump is on the same level as the stoking floor and the clinker is dropped over a vertical wall and is then loaded in carts and hauled to low undeveloped land a few hundred feet distant. While withdrawing the clinker, regulating valves are operated so as to shut off the air supply coming from the air heater.

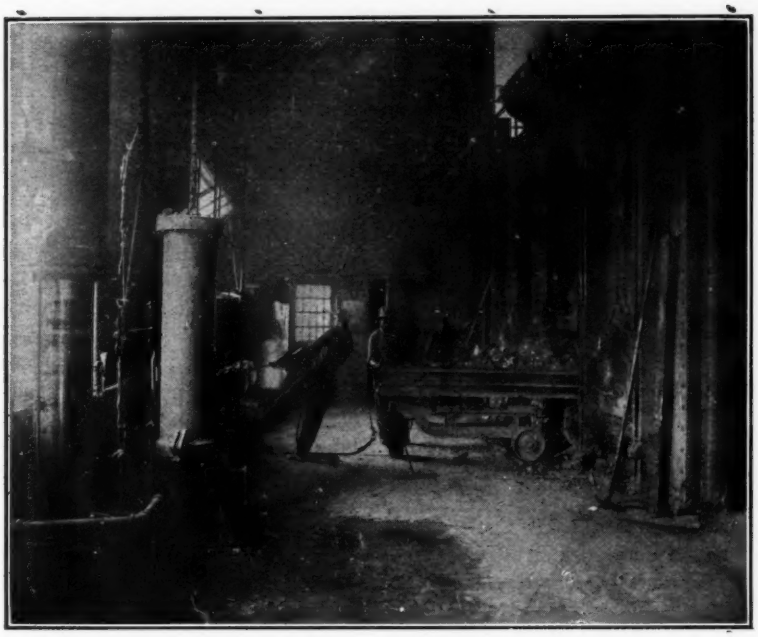
One great advantage of the furnaces at this plant over the furnaces constructed at many other plants is that a deep fire is maintained, which enables the wet portion of the refuse to be more thoroly dried and destroyed than in shallow grates. In my opinion the success of this plant is partly due to this particular feature.

The average time of burning charge is 20 minutes. Usually six charges are made for each clinker produced on the grates. When the plant is working at its full or nearly full capacity the labor required is operated in three shifts of eight hours each. With the destruction of from 60 to 75 tons of garbage only one unit is used with three shifts of labor. This is better than to use two shifts, working both furnaces, for a more even supply of steam is delivered to the pumping station.

During July and August, when the delivery of watermelon rinds and other vegetable matter delivered to the plant averaged 20 tons daily, of course this amount of extra wet garbage, bringing the percentage of garbage above the guarantee, was only destroyed by adding dry material that had sufficient heat units in same to offset the excessive moisture in the garbage. This was brought about by adding about 10 per cent. in weight of cinders collected from manufacturing plants. With the addition of these cinders complete combustion of the garbage was obtained. The extra cost of the cinders was only the cost of drayage from the plants to the destructor plant.

From the day the plant commenced to consume the garbage on March 24, 1914, to the present date, all of the refuse delivered to the plant has been consumed and none had to be hauled away. The amount saved in fuel at the water works plant from March 23d to October 1st was a little over $3,000, or approximately $500

SAVANNAH DESTRUCTOR. *Stoking garbage on the furnace grates. Two units of four cells each, all shown in the photograph but cell No. 1 of the right-hand unit.*



SAVANNAH DESTRUCTOR. *Drawing clinker from grate into clinker car. Note greater ease of drawinig clinker by means of the apparatus provided than removing by hand, as in earlier furnaces.*

per month. Some changes have been made whereby there will be considerable increase in the amount of fuel saved and it is anticipated that from now on the saving will amount to about $600 per month. If the refuse delivered to the plant equals the capacity of the plant, sufficient steam will be furnished to operate the pumping station entirely and a saving of approximately $12,000 would ensue to the city.

The pumping station has two ten-million-gallon duplex compound Holly-Gaskill pumping engines and two cross-compound air compressors, all of which are operated condensing. The steam pressure carried at the water works plant is 90 pounds, but at the destructor plant is carried up to 150 pounds, with 100 degrees superheat. The pressure, however, is reduced by passing thru a reducing valve on the main steam header in the boiler room of the water works.

The total amount of refuse consumed from March 24, when the plant was completed, to September 30, was 14,364 tons. The cost of operating the plant was $8,190 and there should be added salary of weighman, amounting to $428, and a laborer at the pit supervising the dumping of the cars, amounting to $370, making a total cost for destroying the garbage of $8,988, or a cost per ton of 62¼ cents. Allowing for the saving of fuel at the pumping station for this period the net cost for destroying the refuse was 41.6 cents.

The percentage of clinker obtained from destroying the refuse varies from 20 to 30 per cent. of the total of refuse burnt. During the season when the refuse is dry the weight of the clinkers is from 20 to 25 per cent. During July and August this varies from 25 to 30 per cent. It will be seen from the above that the unit cost of destroying the refuse was higher than the guaranteed cost, but it must be borne in mind that the guaranteed price is based upon the plant working at its full capacity, for then the amount of labor would be practically the same as when one-half of this amount was being consumed.

The cost of destroying the refuse, the amount of evaporation of water, and steam obtained is based on the refuse having the following percentages of material:

45 per cent. garbage.
40 per cent. rubbish.
10 per cent. ash or cinder.
5 per cent. manure by weight; the garbage to consist of organic material, vegetable and animal with water and grease; rubbish to consist of paper, rags, excelsior, straw, glass, etc.

Labor for each shift: One man to feed hoppers, four stokers, one engineer, one craneman and one man per watch, making total labor charges per watch $17.50, or $52,50 per day of twenty-four hours. This, however, is not expected to be adhered to, and with the amount of refuse to be destroyed less than 130 tons daily the cost of labor will be considerably reduced.

On June 4, 1914, a trial test lasting eight hours was made with a running start. The refuse was selected so as to comply with the specifications by which the contract is expected to be carried out. Sufficient steam was furnished to the water works during the twelve hours to operate entirely the plant, which would indicate a saving of coal at the rate of about $1,000 per month. The total refuse burned was 86,666 pounds. The actual duration of the test was 7 hours and 35 minutes, making the consumption somewhat above the guarantee. The total refuse burned per square foot of grate surface was 72.25 pounds, whereas the contractor's guarantee was 68 pounds. The average temperature of the combustion chamber during this test was 2,100 degrees, the guarantee being 1,500 degrees. The total water evaporated for compound refuse was 1.53 pounds, against 1.3 pounds, the guarantee. The estimated horse power in operating the plant was 118, the excess horse power being 452. The total number of charges made for both furnaces was 166. The number of times clinkers were drawn from both chambers was 26.

On June 25, 1914, a twenty-four-hour test was made, the actual duration of same being 23 hours and 15 minutes. The type of refuse destroyed was that guaranteed by the contractors to fulfill their contract. The total refuse per square foot of grate surface per pound was 69.94, above the requirements. The average temperature in combustion chamber was 1,862 degrees. The water evaporated per pound of refuse was 1.49 pounds; total boiler horse power developed per hour was 482. The horse power used in the plant was 118, giving an excess of 364, as against 330, the contractor's guarantee. The total number of charges of both furnaces was 440.

The final test was made on August 21-22. While the duration of the test was to be 24 hours, the amount of refuse delivered during this period, 138 tons, was destroyed in 21½ hours. The detailed data as regards this test are as per statement accompanying.

From the operation of the plant and from the test made, the opinion of the writer is that Savannah has a high temperature incinerating plant capable of destroying without difficulty 130 tons refuse per day, of furnishing by-product steam of an amount that will result in a saving of at least from $6,000 to $7,000 per year with the refuse now delivered to the plant. The plant has now been in operation for six months. No defects have been noted and no changes of any moment have been made since the plant was first put in operation. The city is destroying this garbage in a sanitary manner. It has been noted during the summer that the fly trouble has been very much less than in years past, and by some this is thought to be due to the elimination of the dumping of the refuse near the city.

I highly recommend to moderate size cities the destroying of garbage in the same manner as Savannah is destroying hers. With cities of large populations and where the percentage of grease is greater than 3 per cent. in weight of the true kitchen waste, the method of destroying garbage by the reduction process may be favorably considered.

Results of Test of Heenan Destructor at Savannah, Ga., August 21-22, 1914.

Duration of Test—From 3 a. m. August 21 to 12:30 a. m. August 22, 21½ hours.

Type of Refuse—Garbage, 45 per cent.; rubbish, 40 per cent.; manure, 5 per cent.; ash, 10 per cent.

Type of Destructor—Two 4-trough grate furnaces with forced draft.

Number of Furnaces at Work—Two.

Total Grate Surface—160 square feet.

Type of Boilers—Wickes' vertical water-tube equipped with Foster superheaters.

Total Heating Surface of Each Boiler—2,000 square feet.

Total Refuse Burned—277,550 pounds.

Total Refuse Burned per Hour—12,909 pounds; builder's guarantee, 10,833 pounds.

Total Refuse Burned per Square Foot Grate Surface per Hour—80.6 pounds; builder's guarantee, 68 pounds.

Total Clinker and Ash (approximate)—68,608 pounds.

Percentage of Clinker and Ash Obtained from Refuse Burned—24.7 per cent.

Maximum Combustion Chamber temperature—2,000 degrees F.

Minimum Combustion Chamber Temperature—1,700 degrees F.; builder's guarantee, 1,250 degrees F.

Average Combustion Chamber Temperature—1,845 degrees F.; builder's guarantee, 1,500 degrees F.

Average Steam Pressure (Gage)—120 pounds.

Average Temperature of Steam—523 degrees F.

Average Superheat—173 degrees F.; builder's guarantee, 100 degrees F.

Average Temperature of Feed Water—206 degrees F.

Total Water Fed to Boiler—397,162 pounds.

Total Water Evaporated from and at 212 degrees F.—450,382 pounds.

Total Water Evaporated per Pound of Refuse—1.62 pounds; builder's guarantee, 1.3 pounds.

Water Evaporated per Pound of Combustible—2.15 pounds.

Total b.h.p. developed per hour—607 pounds.

Estimated Horse Power Used in Plant for 75 k.w. Non-condensing Turbo Generator Set and Boiler Feed Pump—118.

Excess b.h.p.—489; builder's guarantee, 330.

Average Air Pressure under Grate—3¼ inches.

Average Air Temperature—252 degrees F.

Average Stack Draft—.72 inch.

Average CO_2—11.43 per cent.

Total Number Charges, both Furnaces—447.

Average Weight of Charge—621 pounds.

Total Number Clinkers Drawn, both Furnaces—64.

Cost of Operation—Based on Contract.

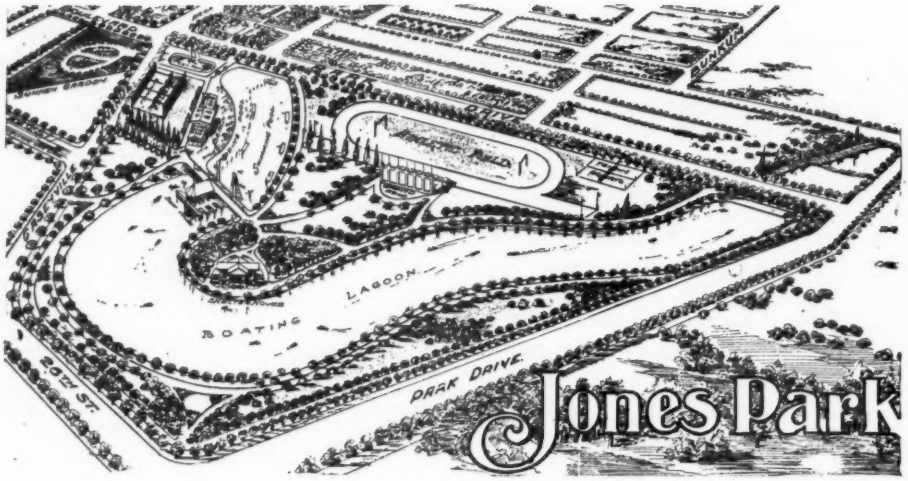
Hoisting—One man per shift of 8 hours @ $2.40	$2.40
Stoking—Four men per shift of 8 hours @ $2.40	9.60
Clinker Removing—One man per shift of 8 hours @ $1.50	1.50
Engineer—One engineer of 8 hours @ $4.00	4.00
Total labor charges per shift	$17.50
Total labor charges per day of 24 hours	52.50
Total labor charges per ton @ 130-ton rate	.404

Cost of Operation—Based on Actual Cost.

Hoisting—One man per shift of 8 hours @ $2.25	$2.25
Stoking—Four men per shift of 8 hours at $1.75	7.00
Clinker Removing—One man per shift of 8 hours @ $1.40	1.50
Engineer—One engineer @ $4.00	4.00
Total labor charge per shift	$14.75
Total labor charge per day of 24 hours	44.25
Total labor charge per ton @ 130-ton rate	.3403
Total labor charge per ton for 138.75 tons in 21½ hours	.318

Tests made with running start. All hoppers empty, and then charged with test mixture. On completion of test, hoppers were empty. All combustion chamber temperatures taken with thermo-electric recording pyrometer. All other temperatures were taken with mercury thermometers. Water measured with a Worthington hot-water meter. Steam pressures taken with a recording pressure gage connected to main steam line. Steam delivered to main header at water works and used to operate one 10,000,000-gallon pumping engine and one 1,850-cubic-foot cross-compound condensing air compressor. From 12:15 to 5:10 p. m. air compressor was operated non-condensing. From 6:30 to 10:30 p. m., 10,000,000-gallon pump speeded up. Steam from plant also used to operate all prime motive units for generation of power for use in plant. At 7 a. m. August 22, all refuse in storage pit was burned, and from then until 8 a. m., insufficient refuse was delivered to keep the plant going at capacity.

Weather during the test was hot and humid, with occasional showers. Test was started at 3 a. m. of 21st and completed 12:30 a. m. of 22d. All calculations based on A. S. M. E. standards. Safety valves of boilers were popping off from 5:30 p. m. until 6:30 p. m.



A PLAYGROUND FOR A SMALL CITY

By Warfield Webb, Chicago, Ill.

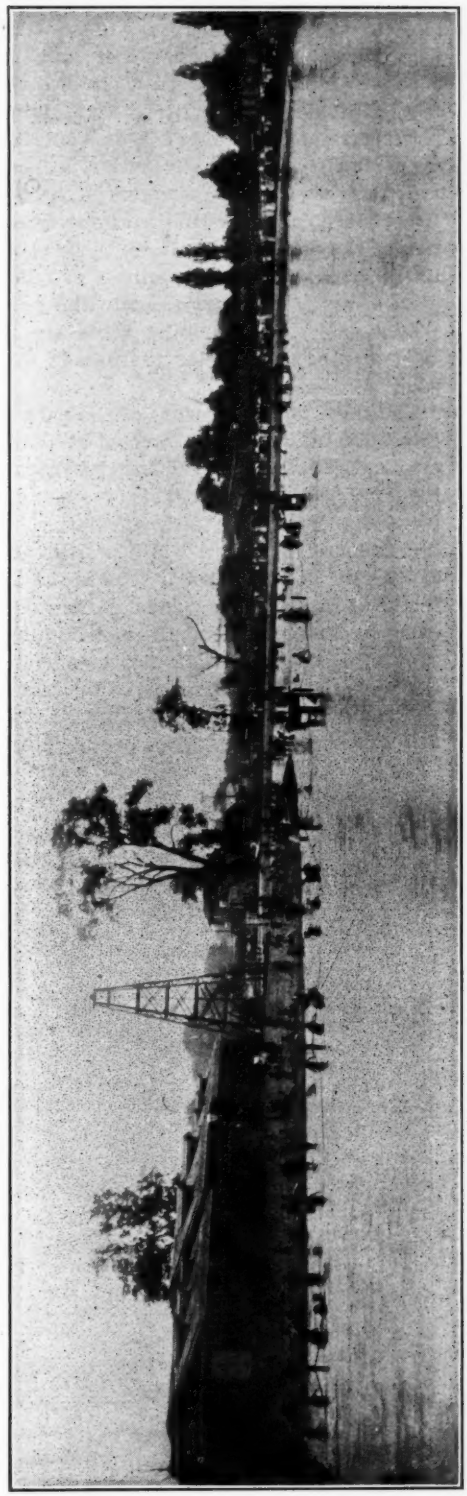
This park shows the possibilities in a Mississippi river bayou in flat bottom land and is a striking example of what energy and ingenuity can do when directed by public spirit and a strong desire to meet a public need.

ONE of the most successful methods of combating the evils of congested life in our large cities has been the adoption of the playground idea by the municipalities, working thru the regularly established park boards. These organized bodies have been given funds wherewith to establish these breathing spaces, and the results in many cities have been such as to foster a far greater good by keeping the children, and the grown-ups, too, in some instances, from the evils of and dangers found in the streets. These nature nooks, placed in the heart of the very thickly populated districts, have been the one saving grace, and have acted as refuges wherein many a child has been protected from outside influences that are sure to make of the adult a citizen that is many times undesirable, to say the least.

Chicago has taken the lead in this respect, but there are other cities which have profited by the example, and have even gone a step further toward the ideal that will eventually predominate in many sections. The playground itself is of small value to the residents unless there are amusement devices, so that the hours spent in this retreat can be made more enjoyable, and at the same time prove a real source of physical well being to the visitors. These have been multiplied in number and character from time to time in some cities, and the newer and most modern of these smaller parks are models of service to the housed-in population.

Perhaps the most pretentious of these parks was opened several months ago at East St. Louis, Ill., and was given the name of Jones Park. This park comprises a tract of 46½ acres, and has been laid

THE SWIMMING POOL *in Jones Park, East St. Louis, Ill., with the bath-houses and dressing rooms on the left.*



out with the sole idea of making it a pleasure resort for the residents and visitors of the city. It has a natural forest growth and a very attractive scenic effect, but to this have been added many features, making the total cost of the same $75,000, including the purchase price of the ground.

The city of East St. Louis established a park board a few years ago, and, like other boards of this kind, it was given the power to construct boulevards, parks and kindred work. Since its inauguration there have been established several small parks in the city, but this latest and deservedly praised public playground ranks with any other in the country. To make this possible no expense was spared, and the object, that of placing at the disposal of the people a park of more than commonplace charm, has been realized.

The main features of this park are, a large open-air swimming pool, lagoon, grand stand and rest house. The lagoon, which covers about seventeen acres, is 200 feet wide and a half mile in length. Overhanging willows add to the natural charms of this boating and canoeing resort. The greatest depth in any place does not exceed four feet, thus insuring a safe depth and still permitting the easy movement of the boats. At one end of the lagoon a large and attractive boat house has been erected, and ample space has been permitted for the docking of the boats.

One other feature that attracts much favorable comment is the open-air swimming and bathing pool, which cost $7,000. In connection with it is a bath house, 165 feet in length by 36 feet in width. This will accommodate 376 men and boys and 190 women and girls. The cost of this structure was $8,000. Directly in front of the bath house is a 3-acre sand beach, making it possible to enjoy the delights of the seashore at home. The depth of the water has been regulated so as to make it perfectly safe. The shallow sec-

tion varies from six inches to four feet, and covers about 78,000 square feet. The deep water section is 450 feet long by 120 feet wide, and reaches a depth of eight feet. This has been provided with diving platforms and spring boards, offering every facility for aquatic sports. There are 4,678,500 gallons of water in the entire pool. To insure the sanitary qualities of the water at all times, there is an influx of 800 gallons per minute supplied from a well located adjacent to the pool. Water polo and swimming races are to be a part of the regular pastime in this pool.

The most notable feature of the park is the concrete grandstand, erected at a cost of $10,000, and having a seating capacity of 1,000 persons. This grandstand faces a quarter-mile track, the latter being twenty-five feet in width and having a 200-yard straight-away. The space directly in front of the grandstand is given over to baseball, football and kindred sports. Directly beneath the grandstand the space has been given over to lockers and shower baths, to be used by both men and women who participate in the games.

Other sections of the park, comprising seven acres, are given to tennis courts. Then there is the regular playground for the children, all ages being deemed children here. Here are found swings, sand piles, croquet grounds, courts for horse shoes, quoits, toboggan slides and other sports that delight the visitor.

The rest house, an essential of park equipment, is two stories in height and is constructed of a pleasing pattern of fire brick. It cost $17,000. On the lower floor are found sanitary drinking fountains, comfort stations for both sexes and a hallway, and on the upper floor a covered pavilion that overlooks a dense grove. Easy chairs and settees are here in abundance, and a space for band concerts. This section has been particularly assigned for the meeting of social organizations that will find it a place of pleasure and restfulness. It is also intended to be a haven for mothers, who may come here and rest and still enjoy the delights of the park.

The natural beauty of the park was not materially damaged by the erection of the buildings, but other trees have been planted, and these will in a few years add their charm to the place. All wires are underground, and the walks are of concrete. Other facilities such as drinking fountains, settees, waste baskets and every convenience, have made this park one of the finest examples to be found today in any city.

THE SHELTER HOUSE *in Jones Park, East St. Louis, Ill. The foreground shows that the patrons of the park have not yet learned their part in keeping a park beautiful by keeping their litter off the grass.*

EXPERIMENTAL PLANT FOR TREATING SEWAGE

AT BROOKLYN, N. Y.

By George T. Hammond, Engineer in Charge.

The plant for making experiments on the treatment of the sewage of Brooklyn, N. Y., has not been in operation long enough to warrant the publication of definite statements of the results of its operation, but the general observations of its action are so satisfactory that this description of its general features is warranted and will be of value to other cities considering the installation of experimental plants. The article is abstracted from a paper before the American Society of Municipal Improvements, which goes into greater detail of measurements. The accompanying photographs will illustrate the description.

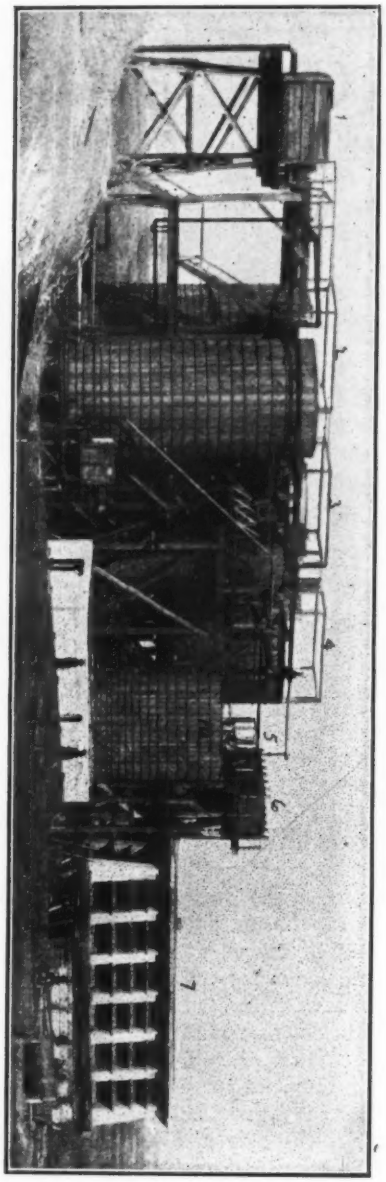
THE object of this paper is to present a brief description of an experimental plant for sewage disposal investigations recently designed and installed by the Bureau of Sewers, Brooklyn, N. Y. This plant was designed and constructed in response to a resolution of the Board of Estimate and Apportionment, of the city of New York, which authorized, for the purpose of constructing the plant and carrying on the experiments, the sum of $50,000.

The experimental plant is located in close relation to the existing New Lots, or Twenty-sixth Ward, sewage disposal plant, and obtains its sewage from the main sewer, which serves the Twenty-sixth Ward district of Brooklyn. The sewerage system, for which this sewer is the outfall main, serves a population of about 200,000, occupying an area of approximately 5,000 acres. The sewers are on the combined plan and have rather flat grades. The disposal plant is about two miles from the center of population and the sewage becomes septic, during the warm months of the summer, before reaching the outlet. A new disposal plant is urgently needed for this district, and has been authorized, the design to await the results of experimental study to determine the most suitable method of treatment for local conditions.

The experimental plant consists of three Imhoff tanks, each of different depth but with other dimensions equal; six sprinkling filters, two of which receive forced aeration within the mass of the medium; various tanks and apparatus for the investigation of sewage treatment by forced aeration; secondary settling tanks for the sprinkling filters and the sewage treated by forced aeration; a plain settling tank for crude sewage in connection with an airtight sludge digestion tank, which receives settled matters and sludge from the plain tank, being in effect the two essential portions of an Imhoff tank separated; a roughing filter; ten sludge drying beds; various experiments for screening sewage, and for drying sludge, including a fixed mesh screen, a rotary disc type screen, and a canvas vacuum filtration system; various provisions for disinfection experiments, etc.

The mechanical plant consists of steam-actuated sewage pumps and an air compressor.

The twin sewers pass, at the location of the existing disposal plant, thru a silt



VIEW of Brooklyn sewage experimental plant from the south.

1. *Quieting tank into which pumps discharge and from which sewage flows with determined constant head to treatment tanks.*
2, 3, 4. *Imhoff tanks Nos.* 1, 2 *and* 3, *partly hidden by other structures.*
5. *Roughing filter at end of dosing tanks.*
6. *Dosing tanks.*
7. *Sprinkling filter bed before construction of wind shield around tops of beds.*
8. *Aerating tank.*
9. *Aerating siphon.*
10. *Sprinkling filters with forced aeration. At their base settling tanks and sludge drying beds.*
11. *Secondary settling tanks below the sprinkling filters* (7).

basin which, in dry weather, acts as a grit chamber for the sanitary sewage. This basin, which is covered with a masonry roof carried on I-beams and piers, is 80 feet by 60 feet in interior dimensions, and 9 feet deep.

The pumps that furnish the sewage for the experiments are located within the existing disposal plant building, and steam is obtained from the boilers of the plant. There are two sewage pumps, both of them direct acting piston pumps, installed so that either pump may be cut out and cleaned or repaired without stopping the other, with capacity of 1,200,000 and 650,000 gallons a day. Provision is made for placing a movable screen around the lower end of the common 12-inch suction pipe thru which both pumps operate, which is cleaned by means of a water jet and brush.

The sewage for experiments is discharged from the pumps thru an 8-inch iron pipe into the quieting tank, which supplies sewage to the various units of the experimental plant by gravity.

As the experiments include an extensive study of sewage aeration by means of compressed air, an air compressor is installed with a displacement capacity of 228 cubic feet of air per minute at not exceeding 210 r.p.m. for 30 pounds air pressure, with 100 pounds of steam at the throttle. The air passes from the compressor to an air receiver, of steel, 24 inches in diameter and 72 inches high, with pressure gage and safety valve.

The low elevation of the ground, a tidal marsh, requires the plant to be above the reach of the highest tide, and pumping of the sewage to a level from which a gravity flow could be obtained for every unit of the plant.

Every unit was provided with a measuring device for the determination of the quantity of flow, usually consisting of an

adjustable calibrated orifice above which a constant head is maintained by a system of overflow weirs.

For measuring compressed air, venturi meters were provided.

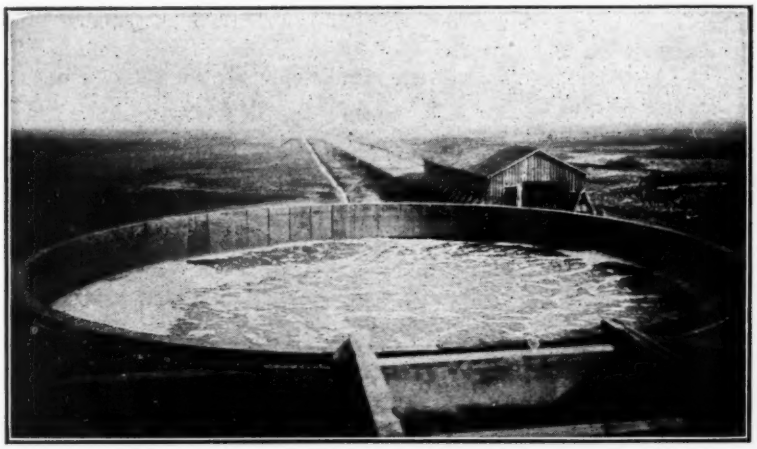
The above-ground construction of the plant affords opportunity for studying the flow of sludges of different kinds, Imhoff especially. The effect of cold weather on exposed sprinkling filter beds, and the danger of freezing of the various channels carrying sewage, and the proper method of protecting and operating the same, are incidental studies of great importance in view of the projected construction of a plant on piles over an extensive marshland.

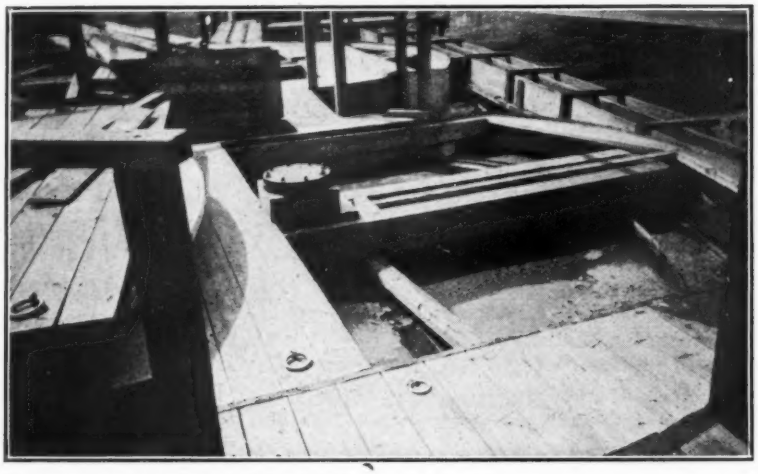
Early in the studies which preceded the design of the experimental plant it was of importance to ascertain the quantity of sewage flow per day and per capita from the drainage and sewer district, the entire flow passing into Jamaica Bay at this point through the main sewer, as already described. This was done by means of a knife-edge weir 26.83 feet long, with end contractions suppressed, installed in the open outfall trunk sewer.

The quieting tank stills the flow coming from the pump, and supplies a regulated supply of sewage to every part of the plant, maintaining a constant head in the supply at an elevation of 33.42. This tank is rectangular in shape, 5 feet in depth, and 12 feet 3 inches by 8 feet 10 inches in plan. In its interior each end is divided off by a partition, forming overflow chambers, which are connected with the waste pipe; the main chamber is between these internal partitions and is 9 feet in length by 8 feet in width. Each partition is cut down to the waterline a distance of 3 feet from the outlet side of the tank, forming overflow weirs designed to maintain a constant head over the outlet orifices. Two baffles are placed lengthwise of the tank, between the above mentioned partitions and normal to the line of flow. The baffle nearest to the entrance of the sewage extends 3 feet upward from the bottom, and is 2 feet 6 inches from the entrance side of the tank. The other baffle extends downward, from the top of the tank, to within 1 foot of the bottom, and is 2 feet 6 inches from the first baffle, parallel with it, toward the outlet side.

In the side of the main chamber of the tank, opposite to the entrance of the sewage, are placed six outlets, each provided with an adjustable orifice having a calibrated scale, which may be set to any rate of discharge within its range of capacity. These orifices discharge into flumes that lead to the various experimental units, each orifice into a flume which it serves. The means of maintaining a constant head is, in all cases, an overflow weir, over which a surplus flow is kept wasting to a

AERATING TANK, *showing surface of sewage under aeration. Either raw sewage or effluent from Imhoff tank can be aerated as desired.*





IMHOFF TANK *with deck removed. Note a slight scum has formed, after one week without disturbance, on which algae are growing. No sulphuretted hydrogen smell at any time.*

lower level, where it may be used, if required, for other experiments or led back to the main sewer.

The Imhoff tanks, three in number, differ only in depth, each being provided with a sedimentation chamber with the depth proportionate to the depth of the tank in which it is placed, so that the effect of depth (other conditions being equal) may be observed in the comparative performance of the tanks.

The scum boards, placed 12 inches from and opposite the entrances and exits of the tanks, are in all cases 2 feet in depth, and no other baffling is provided for in the first series of experiments. The dimensions of the horizontal section of each sedimentation chamber, at the lower edge of the scum boards, are equal in every particular in all the tanks; and the entrance and exit weirs are of identical design and dimensions. When the experiments upon the comparative effect of depth in sedimentation chamber, and sludge digestion chamber, have been completed, baffling will be provided in connection with experiments upon rates of sedimentation at various rates of flow. The sedimentation chamber of either of the tanks can be temporarily removed and a rearrangement made for Dortmund tank experiments. Connections can be made so that the whole three can be operated in series, either as Imhoff tanks or as Dortmund tanks, by a few inexpensive changes. Each tank is 15 feet in internal diameter. The inlet and outlet of each tank is made of galvanized iron, forming a distributing or a collecting chamber, as the case may be, in front of the entrance weir, or outside of the exit weir, which weirs are both full width of the sedimentation chamber; the aim being to distribute the flow uniformly, and to take off the effluent in the same manner.

The sedimentation chambers are of pine, easily removed and reconstructed. The sloping floors, which are of 2-inch pine, planed smooth, were placed first, after which the vertical sides were put in place, which are of 1¼-inch pine, planed smooth, their lower ends resting upon the sloping bottom planks, so as to eliminate a vertical joint. These vertical walls are 10 feet 8 inches between sides and a maximum of 2 feet between these and the outer shell. The sides and sloping floor are of tongued and grooved boards, carefully matched and smoothed inside. The spaces between the vertical walls and outer shell serve as gas outlets for the digestion chamber.

In making the openings from the sedimentation chamber for the passage of settlings into the digestion chamber, the inclined floors do not lap or pass, the one

in such tanks, the intention being to study the form of opening by changing it, perhaps several times; the form at present installed having been considered the most troublesome to try out was selected for the first trial. There is some reason to think that this form of opening is less liable to become clogged than the form ordinarily used, and in six months' service it has worked so well that no collection of settlings has at any time remained upon the slopes. The opening is guarded by means of a timber shield or baffle board placed below it with its upper slopes the same as the bottom slopes of the sedimentation chambers, thru which the sludge pipe passes at the center of the tank, care having been taken to make the pipe passages gas tight thru the wood. The sludge pipe in each tank is 8-inch iron pipe with a flange at the top, provided with a cover, and is carried by two 6-inch by 8-inch yellow pine timbers crossing the top of the tank; the pipe is suspended from iron channels crossing from timber to timber and placed under the flange at the top. The sludge pipe is provided with a branch pipe for drawing sludge, which passes thru the side wall of the tank, having a gate valve and being connected with the sludge outfall channel into which it discharges.

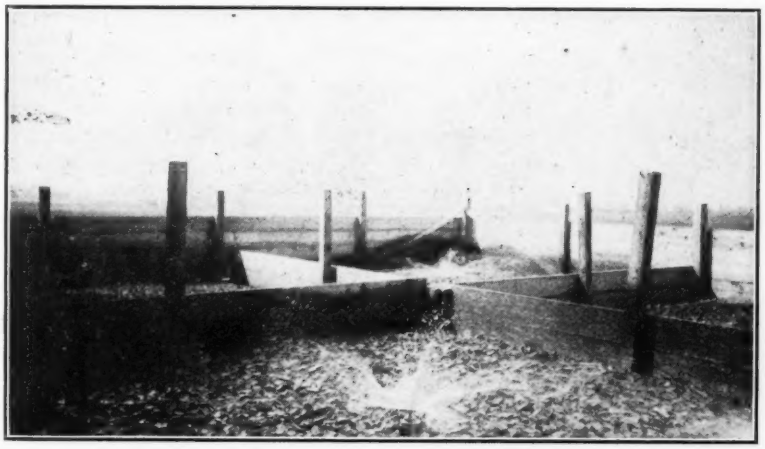
The bottom of each digestion chamber is formed inside of the cylindrical tank, in the shape of an inverted truncated hexagonal pyramid, made in two sections, the upper overlapping the lower. A perforated lead pipe, 1¼ inches in diameter, connected with the city water suply, and controlled by a gate valve, is placed entirely around the tank, under the overhanging edge of the upper pyramid, for use to start the sludge sliding down the slopes, if necessary, and for cleaning the slopes.

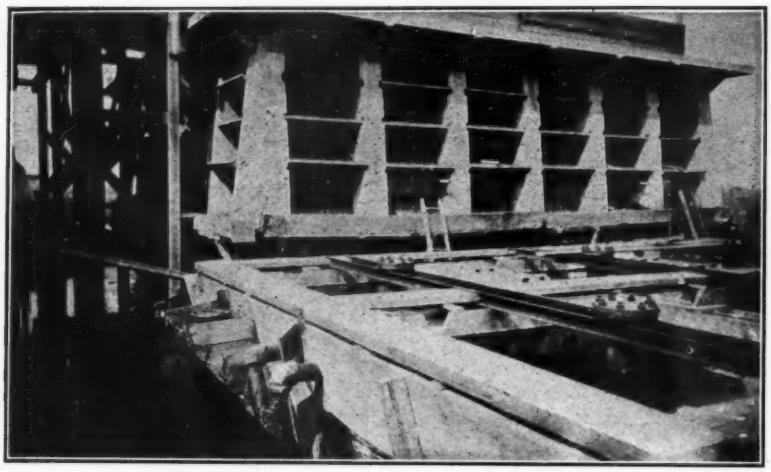
The effluent from the tanks may be distributed by gravity from the outlets to all the experimental units where its use is required. Provision is made to return surplus to the main sewer by waste pipes of iron, 4 inches in diameter, which are led down the sides of the tank, affording branch connections, provided with gate valves, for tapping the tank at lower points. Thus it is possible to entirely discharge the contents of the sedimentation chamber without disturbing the sludge digestion chamber. It is also possible to obtain samples of sludge from the bottom of the tank without the disturbance that would be caused by drawing thru the 8-inch sludge pipe, or to discharge the entire contents, when repairs or alterations are required.

The tanks are covered on top, except for the opening over the inlet and outlet weirs, with movable floors, made of 2-inch pine plank, in sections, with lifting rings for handling.

The Imhoff tanks differ only in vertical

SPRINKLING FILTERS, *two in operation, with wind breaks to prevent irregular action.*





SPRINKLING FILTERS *as seen from the sides. Tops of secondary settling tanks are in the foreground.*

dimensions and cubic capacity, as follows, the depths being given inside from the water line downward:

	Depth of Tank at Center, Feet.	Depth of Sedimentation Chamber— Vertical Center.	Side.
Tank No. 1....	30.38	9.22	13.97
Tank No. 2....	21.88	5.30	10.05
Tank No. 3....	13.67	2.42	7.00

Changes in the sloping bottoms, of sedimentation and sludge digestion chambers, are easily possible; also in design and width of the opening between the upper and lower chambers. The slopes were provided to begin with as flat as was thought safe, but so far they have not retained any sediment and probably might have been flatter without causing trouble. These tanks have been operated since October 4, 1913. Probably the smooth timber surface affords less friction to the sliding of settled matter than would concrete. It is intended to cover the slopes with a concrete surface, before the completion of the experiments, to investigate this question.

The effluent from the Imhoff tanks flows by gravity to the following units, all of which may be simultaneously in action:

1. The sprinkling filters and roughing filter.
2. The aerating tank.
3. The aerating siphon.
4. The sprinkling filters with compressed air aeration.
5. To a secondary settling tank.
6. To disinfection tanks.
7. To mechanical vacuum filter tanks of the Moore pattern.

Sludge for testing and drying is discharged to the Imhoff drying beds; the surplus sludge is washed into the main outfall sewer.

Plain sedimentation experiments are provided for in a tank of the Dortmund type, which is one of a group of four tanks, each of the same size and design, constructed of concrete, 8 feet by 8 feet in interior plan and 8 feet deep from the water line in the center, the bottom being designed of pyramidal form. The other three of these tanks are used as secondary settling tanks for observing the effluents of the aerating siphon, aerating tank and the Imhoff tank. The flow, entering, is carried down under the center of the tank and, rising, is taken off thru V-shaped notches, of which two are provided on each side, into wooden troughs which completely surround the top of each tank. A 6-inch sludge discharge pipe is placed in the center, terminating with a bell at the bottom and provided with a

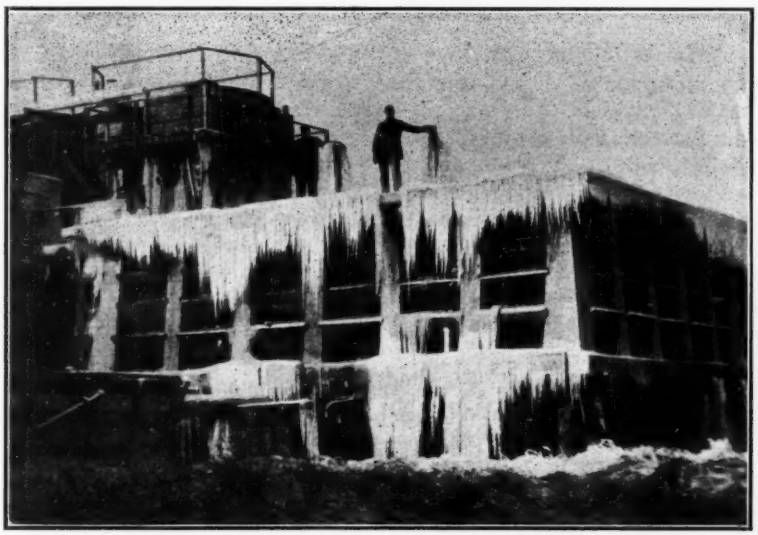
clean-out at the top of the vertical portion above the water surface. Sludge is discharged thru a horizontal branch, passing thru the tank wall below the water line, into a flume that carries it to the sludge beds. The tank selected for raw sewage sedimentation has, in addition, a sludge discharge pipe branching from the pipe described above, which passes to a sludge digestion tank especially provided for the purpose of experimenting with sludge taken from raw sewage.

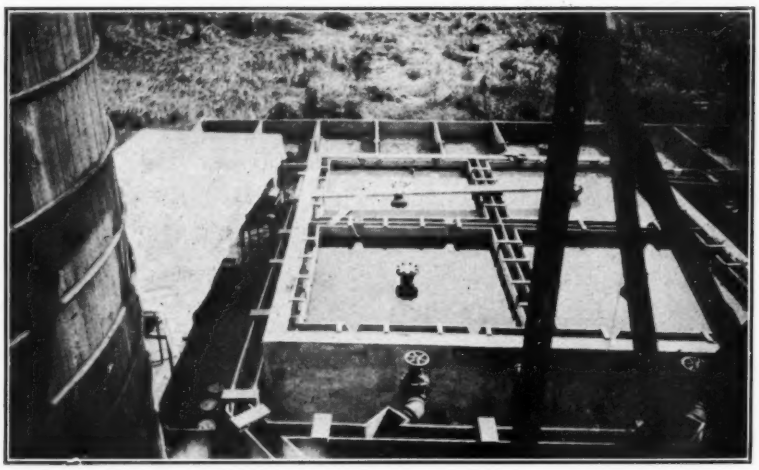
The sludge digestion tank is of steel, made to be air and water tight. It is 5 feet in diameter and 15 feet in depth, with a pyramidal bottom, set vertically in the ground so that no part of it shall be above the water line of the plain sedimentation tank from which it receives sludge. The effect of varying temperature or of chilling from ground water is minimized by a double shell with an air space between shells. In operating the tank sludge is drawn from the settling tank under water pressure due to the head of water in the tank, by means of a branch in the sludge pipe, and passes thru the sludge inspection box after opening the valve into the digestion tank. The sludge remains in the digestion tank until it is digested. Before any sludge enters it is necessary to let out enough of the water from the top of the tank to furnish sufficient difference of head for the sludge to flow in. The digested sludge is discharged upon the Imhoff drying beds by means of the sludge pipe in the same manner as from an Imhoff tank.

Direct aeration experiments may be carried out with raw sewage supplied from the quieting tank, or with the effluent of the Imhoff tanks. The principal direct aeration experiments provided for are to be carried out by means of an aerating siphon, and an aerating tank. Experiments will also be made with sprinkling filters supplied with compressed air thru a grid placed within the mass of medium.

The siphon aerator may be operated with raw sewage or Imhoff effluent. The flow of sewage is led, by gravity, to the bell at the top of the siphon down-take pipe, into which the sewage falls, entraining or sucking the air in with it, and passing vertically downward thru the pipe with considerable velocity, the entrained air becoming compressed. It is claimed by the patentee that the sewage exposed to air under pressure absorbs a greater portion in consequence of the pressure, as the volume of air absorbed will be in pro-

SPRINKLING FILTER *beds and dosing tanks at five degrees below zero continued in full operation. Wind breaks not in place on the surface.*





SECONDARY SETTLING TANKS *in the foreground and sludge drying beds in the small boxes immediately in their rear.*

portion to the pressure. The apparatus consists of a 4-inch pipe extending vertically downward, 130 feet from the bell at the top; first thru the center of a vertical tank 30 feet deep and 4 feet in internal diameter, and, second, from the bottom of the tank thru an 8-inch pipe, leaving an annular space thru which the sewage can flow upward from the bottom of the 4-inch pipe into the vertical tank, in which it is retained for a period of time in proportion to the quantity of flow and capacity of the tank. The effluent is discharged from the top of the vertical tank by means of a waste pipe and a measuring orifice box from which a portion of the flow is led, for observation, to the settling tank.

The tank aerator is for the purpose of experimenting, both upon crude sewage and Imhoff tank effluent, with forced aeration, either by fill and draw or constant control. It is a tank 12 feet in diameter and 25 feet 8 inches in height. The sewage enters at the top of the tank by gravity at eight points from the quieting tank or the Imhoff tank outlets. The sewage may fill the tank so that these points of entrance are submerged, or the tank may be operated at lesser depths of contents. The sewage or effluent of the tank is taken off at the bottom by means of four 3-inch openings into a 5-inch pipe.

A grid for supplying compressed air is placed at the bottom of the tank, upon 7½ inches of broken stone, the same depth of broken stone being placed over it. The grid consists of 1½-inch pipe at right angles, forming a cross, connected in the center, the arms of the cross being connected with quarter-circles of ¾-inch pipe forming concentric rings, of which there are five; each ring being perforated at 6-inch intervals with 1/16-inch holes. The air enters thru the 1½-inch pipes and is distributed thereby to the rings, and is discharged into the broken stone surrounding the grid, which tends to break up any upward stream effect.

The main outlet for the tank effluent is 1 foot above this grid.

Thru the central axis of the tank is placed a vertical 4-inch pipe which serves to center and support the deflector discs, of which there are nine, provided for the purpose of deflecting the downward flow of sewage and upward flow of air bubbles, so as to obtain even distribution of both air and sewage.

The deflectors are designed in the form of a wheel with a hub which is of iron; six radial arms are provided between which slats are placed, running from arm to arm, the slats being set in grooves in the arms and at an angle of about 45 degrees with the horizon, the slats in each alternate deflector being set at angles alternating from and toward the center in order to give the sewage a sinuous motion in passing downward.

There are six percolating or sprinkling filter beds, all of them supplied with sewage by means of dosing tanks, and the sewage applied may be

(1) crude from the quieting tank;

(2) aerated sewage effluent from the siphon aerator;

(3) aerated sewage effluent from the aerating tank;

(4) settled sewage from the Imhoff tanks;

(5) any of the foregoing passed thru a gravel roughing filter;

(6) effluent from fine screens of the Reinsch-Wurl pattern (not yet installed).

The sewage flows by gravity to the dosing tanks, except the fine screen effluent which requires pumping.

Each dosing tank is provided with a 5-inch Miller siphon which discharges the dose into the inverted pyramidal feeding tank from the bottom of which it is carried by a pipe embedded in the medium to the sprinkling nozzle, by which it is sprayed over the bed. The gravel roughing filter is so arranged that sewage, on its way to the dosing tanks, may be passed thru it; the medium provided is gravel passing a ¾-inch ring and retained on a ½-inch ring. The gravel is 12 inches deep, supported in the middle third of a wooden tank by means of a wire screen of ¼-inch mesh. Such a filter has been found very effective by Mr. Watson at Birmingham for protecting the spraying nozzles. It is very effective as a remover of hairs and small particles that have escaped the settling tank. The roughing filter may be used or by-passed at will.

The sprinkling filters, served by a single group of dosing tanks, are divided into two groups, the first of four filter beds of the ordinary type; the second of a tank 12 feet in diameter and 16 feet high, in which are placed separated two beds, each side filled with stone filtering medium to the same depth, and each is underdrained with 6-inch half-pipe tile on a concrete bed, draining independently to a secondary tank, and is closed from external air by the tank walls, separate from the other. Each side is provided with a grid, for supplying compressed air, placed within the medium near the bottom of the beds, formed of ¾-inch iron pipe perforated every 6 inches with ⅛-inch holes, thru which the compressed air is supplied. In operation, the sewage is sprayed upon the surface of the beds by a single nozzle placed at the center of the two beds, over the dividing wall between them. Both beds may be operated as ordinary sprinkling or percolating filter beds, in which case air is carried into the bed from the surface only. Compressed air may be supplied to both sides at the same time, or one side may be operating as an ordinary sprinkling filter, while the other is operated as a sprinkling filter with compressed air added in the bed, in order that the effluents may be compared and the effect of the added air be observed.

The filtering medium in both sides is best selected trap, broken to pass a ring 2½ inches and be retained by a ring 1¼ inches in diameter. The depth of the medium is 10 feet, which may be increased to 14 feet by adding to the surface and raising the nozzle.

Size of Medium in Filter Beds.

Bed No. 1, stone passing ring 1½ inches in diameter, retained by ¾-inch ring.

Bed No. 2, stone passing ring 2 inches in diameter, retained by 1-inch ring.

Bed No. 3, stone passing ring 2½ inches in diameter, retained by 1¼-inch ring.

Bed No. 5, stone passing ring 2½ inches in diameter, retained by 1¼-inch ring.

Bed No. 6, stone passing ring 2½ inches in diameter, retained by 1¼-inch ring.

Bed No. 4, stone passing ring 2½ inches in diameter, retained by 1¾-inch ring.

In order that the effect of the depth of filter medium under similar conditions of operation may be obtained, test trays with outlet pipes are placed in the filter beds at different depths. The trays are V-shaped, 10 inches wide, and extend from the wall to the center of each bed. Each is provided with a drain pipe with a stopper, used when samples are being obtained. The trays are so placed that samples may be taken at depths from the surface of the bed of 6 feet, 7 feet 3 inches, and 8 feet 6 inches. Samples taken from the bottom of the bed give the result of 10 feet depth. Thus samples from four different depths of medium are available for observation from each bed.

In order to prevent the effects of wind

on the sewage distribution, a shield is provided, consisting of a board fence at the surface carried between the beds and around them.

The secondary settling tanks to which these filters discharge are placed in a group. Each tank is an inverted truncated pyramid, 10 feet deep from the water line. The flow enters thru a 2-inch pipe down to a point 2 feet above the bottom. Settlings are removed by the hydraulic head of the tank. The tank effluent is taken off by troughs passing entirely around the top of each tank thru V-shaped notches.

For the purpose of testing the character of sludges from the different experimental units, and making observations on rates of drying, sludge drying beds of the Imhoff type are provided. There are 10 beds, each 5 feet wide by 12 feet long, constructed upon a timber platform, each bed supplied with a 6-inch half-tile pipe underdrain, placed along the center from near the inlet to the lower end of the bed. The medium consists of 8 inches of steam ashes surfaced with 1 inch of coarse sand. Timber partitions separate the beds, each bed being in effect a tank into which the sludge is discharged by means of sluices controlled by gates. Sludges can reach these beds by gravity from all of the sludge producing units of the plant.

Disinfection investigations will be undertaken when the various units of the plant have been given sufficient time to develop the best possible effluents, and the Reinsch-Wurl screens, and vacuum filters are in operation. Tanks are provided for the purpose.

The experimental plant was, for the most part, completed in December of last year and put into regular service January 1st of this year. Sufficient time has not yet elapsed to make any results available for publication. The service of the sprinkling filters, during the zero weather of last winter, was accompanied with the formation of considerable ice.

The portions of the plant not yet completed include the major portion of the screening apparatus of which two Reinsch-Wurl screens are intended to constitute an important part.

A THRIVING ARGENTINE CITY.

As an example of the rapid development of cities in the Argentine Republic, Tucuman may serve. It is located in the northern section of the country near the foot of the Andes mountain range, some 24 hours by train from Buenos Aires and 18 from Rosario. It has three railroads to the southeast and one to the north, the latter and one of the former being government lines. The present population of 88,202 in the city proper (95,970 in the urban district) increased 22 per cent. in four years and over 120 per cent. in twenty years. Houses are almost wholly one-story brick, most of them with modern improvements. Real estate brings high prices and still the rented returns are some 9 per cent.

The National Government constructed the water works and sewerage systems at a cost of $2,800,000, and they are managed by it, but will be gradually paid for and then taken over by the province. There are three private electric light and power companies, all now under the control of one of the railways. One of these companies operates the street car lines, of which there are 15.5 miles in operation, with 24 cars, transporting over three and a quarter million passengers a year. This plant is operated by steam. One of the plants utilizes water power from one of the numerous mountain streams of the province. American promoters were interested but the machinery used has been British or Swedish, "followed by German," with but little from the United States. This is but one indication of opportunities for the United States to follow with their machinery.

Electric light rates run from 10.6 cents per kilowatt for small consumers to 5.1 cents for large; power rates from 6.4 cents to 3.4 cents.

Manufacturing has not as yet developed, sugar and alcohol being the principal products, with builders a good third.

BITUMINOUS MACADAM ROADS
IN RHODE ISLAND

By Irving W. Patterson, Chief Engineer of Rhode Island State Board of Roads, Providence, R. I.

The state of Rhode Island laid a number of test sections of bituminous macadam road in 1909, using varying specifications. The chief engineer of the State Board made report upon these experiments at the Atlantic Road Congress, in a paper from which this article is taken. It also includes report upon other bituminous roads laid in the state since 1906.

THE first road built was remarkably successful and is now perfectly intact and presents a perfect mosaic appearance and has required no repairs in the eight years it has been in use.

Another road laid in 1907 was not so satisfactory, probably because the subsoil is less stable. No seal coat was used on either of these roads and the horse traffic is light.

In 1908 many materials and combinations were used with generally negative results, nearly all those differing from those used in 1906 and 1907 giving inferior service.

In 1909 a number of test sections were laid on the Nayatt Point road in the town of Barrington. The road has an average traffic in summer of 350 vehicles a day and less during the winter, largely motor vehicles, with considerable heavy horse-drawn traffic in early spring and late fall. The width of metal is 14 feet, with crown of ¾ inch per foot. No foundations or sub-drains were necessary. Crushed stone was laid to total compacted depth of 6 inches; first course 4 inches of 3 to 1½-inch stone and second course 2 inches of stone mixed by hand on a wooden mixing platform with bitumen of sizes and kinds named below. A 15-ton roller was used.

In experiment No. 1 Connecticut trap rock of commercial 1¼-inch stone, i. e., ½-inch to 1½-inch screen, and half each of crude tar and hard asphalt were used in the top mixture, 18 gallons of binder per cubic yard of stone. The seal coat on ½-inch screenings took ¾ gallon of asphalt per square yard of surface. Cost was $0.827 per square yard.

This section was very nearly a failure. Hair lines developed inside of one month after completion and by the following spring ravelling had become quite extensive. Patching has been necessary every year since construction. What remained of the original surface by October, 1914, appeared rough and hair-lined and numerous breaks were in evidence. The character of the stone employed in the mix was one reason for failure. The percentage of the smaller sizes of stone as compared with the percentage found in native stone was small in the commercial trap rock, so the rolled mixture consequently was far from compact. The combination of tar and asphalt in the mix is also a reason for failure. Such a combination has not given first-class results, altho with some grades of stone the results have been fair.

In experiment No. 2 native stone was used and the amount of binder was reduced to 15 gallons per cubic yard of stone. Otherwise construction was same as No. 1. Cost was $0.788 per square yard.

The results have proven fairly satis-

factory. There have been a few breaks in the surface which required repair. These breaks have occurred with increasing frequency since construction. The cost of maintenance during a period of five years was approximately $0.025 per square yard. Upon examination in October, 1914, the surface presented a smooth asphalt finish except in a very few spots where the seal-coat had worn off and allowed the surfaces of the stones to become visible. A sample of the road taken up, however, showed that there was no appreciable life left in the binder. The material in the seal-coat appeared to be in good condition. The superior success of this section as compared with No. 1 is attributed to the superior grading of the sizes of native stone, with the resulting stronger mechanical bond.

In experiment No. 3, the same construction as in No. 2 was used except that 16.5 gallons of refined coal tar were used per cubic yard, and ⅝ gallon of the same per square yard for seal coat. Cost was $0.838 per square yard.

The results to date have been very satisfactory, altho a complete renewal of the seal-coat is called for. No repairs to the metalled surface were carried out until the fall of 1914, altho the necessity for repair was evident for some time previous. The seal-coat began to disappear noticeably about one year after construction. Two years after construction a true mosaic surface was presented by the exposed surfaces of the crushed stone. The surface gradually became rougher, due apparently to the decomposition of the binder in the surface voids. Ravelling was not in evidence until the summer of 1914. The need for renewal of the seal-coat was felt in 1913, but since the section was experimental, was left to see exactly how long it would be before disintegration set in. Examination during October, 1914 (previous to any repairs being made), showed a rough mosaic surface with occasional evidence of ravelling. Abrasion of the stone by traffic was very evident, the surface being covered with a very light coating of particles of stone, which apparently had been broken off from the stones composing the road surface.

In experiment No. 4, 21 gallons of asphalt were used per cubic yard of stone and ⅝ gallon of asphalt per square yard for seal-coat. Cost was $0.898 per square yard.

The results obtained upon this section are to date superior to the results secured upon any other section. No repairs have been necessitated. Examination during October, 1914, showed a perfectly intact, smooth asphalt finish.

In experiment No. 5, 24 gallons per cubic yard of stone of a mixture of refined tar with 20 per cent. of asphalt was used as binder and the same in the seal coat, ⅝ gallon per square yard. Cost was $0.924 per square yard.

The results obtained upon this section are very fair. The surface became perfectly mosaic inside of two years from the date of construction, due to the disappearance of the seal-coat. No repairs have been given this section, but the need for a renewal of the seal-coat has been appreciated for two years. Inspection during October showed a rough mosaic surface, perfectly intact as far as ravelling is concerned, and slightly darker in color than the surface of section No. 3.

In experiment No. 6, the materials and amounts were the same except that 10 per cent. of asphalt was used in the binder. Cost was $0.917 per square yard.

The results obtained upon section No. 6 were not noticeably different from the results secured upon section No. 5. No repairs have been carried out upon this section to date. Observation during October, 1914, could disclose no differences in appearance or condition from section No. 5, except, perhaps, a slightly lighter color.

In experiment No. 7 refined tar was used in both binder and seal-coat, quantities same as in No. 6. A mixing machine was used, which was a special heated platform upon which mixing was accomplished by pulling by hand the crushed stone thru a reservoir of heated bituminous material. There was no saving in labor. Cost was $0.910 per square yard.

The results secured in this work are not appreciably different from the results described in the report of experiment No. 3, where also a refined tar was employed. Ravelling has not progressed

to the extent that it has upon No. 3, but examination showed evidences of ravelling.

In experiment No. 8 the machine was used and the same amount of refined water gas tar. Cost was $0.932 per square yard.

The results secured upon this section have been very satisfactory. One patch was necessitated about one year after completion, but no further repairs have been needed. The seal-coat has worn off, but decomposition of the binder has not extended down in the surface voids appreciably. Examination during October, 1914, showed a smooth mosaic surface very dark in color as compared with the surfaces of the other sections which appear mosaic. The surface was perfectly intact. The need for a renewal of the seal-coat is beginning to be in evidence.

In experiment No. 9, mixing was by hand. The binder was 18 gallons of crude tar per cubic yard of stone and the seal-coat was ¾ gallon of asphalt per square yard. Cost was $0.816 per square yard.

No ravelling has ever taken place upon this section. The only repairs necessitated to date have consisted merely in touching up spots where the seal-coat had disappeared. The expense of maintenance to date has been less than $0.005 per square yard. A smooth asphalt surface was presented by this section upon examination during October, 1914. There was no evidence of ravelling to be seen, but in a very few small spots the disappearance of the seal-coat allowed the top surfaces of the stones to be seen.

The following conclusions from the above described work and the regular work done since are drawn by the author:

These experiments at Barrington seem to prove that certain forms of the cold mixing method are very satisfactory upon roads subjected largely to motor vehicle traffic. Only two of the sections have necessitated repairs of any account during the five years they have been laid. Both of the sections requiring repair were laid with the same combination of binders, and the much greater extent of repairs necessitated upon the section constructed of trap rock is of interest in consideration of mineral aggregates.

It was shown conclusively that a seal-coat of asphalt is much more permanent than a seal-coat of refined tar, altho both the crude tar and the refined tars gave excellent results as far as their binding of the mineral aggregate is concerned.

The effectiveness of refined water-gas tar is also proven. The section built of this product is superior at present to either section built of refined coal-tar.

In 1910 the typical construction employed was a mixture of crude tar and crushed stone, seal-coated with a heavy asphaltic product. It will be noticed that this construction is identical with the construction employed in experiment No. 9 at Barrington the previous year. The facility with which the crude tar could be handled and the good results secured with this material previously, accounted for its extended use in 1910. The results secured with this type of construction in 1910 were very successful. With one exception these roads have required only the lightest of repairs to date, the exception noted being located upon the main street of a large village and constructed of commercial 2¼-inch and 1¼-inch trap rock. This road had disintegrated somewhat by the spring of 1911, and from that time on the disintegration rapidly became greater in extent. By the spring of 1913 the condition of the surface was serious. Several breaks of 10 square yards or more in area appeared, and small breaks were very numerous. It was decided to patch the breaks with a mixture of ¾-inch trap rock and refined tar and to apply over the entire surface a seal-coat of asphalt covered with clean ½-inch trap rock screenings. Asphalt of approximately 15 mm. penetration was applied at the rate of one-half gallon per square yard of surface and covered while hot with screenings, which were rolled with a 6-ton tandem roller as soon as possible. This work was done in June, 1913. The results of this treatment have proved very satisfactory, no further ravelling having taken place to date.

Mixing in 1910 was accomplished by

the hand mixing method upon wooden platforms.

The crude tar which was used to the greatest extent in our work during 1910 was the product of the Providence gas plant. Since 1910 vertical retorts have been installed at this plant and the crude tar at present produced is not suitable for use by the mixing method without previous refining. The Providence gas house tar used in 1910 was remarkable for its uniform good quality, and we doubt if we could duplicate the results secured that year with any crude tar at present available in sufficient quantity for our need.

In 1911 no appropriation for road work was made by the General Assembly and consequently no bituminous macadam was constructed.

In 1912 an attempt was made to duplicate in effect the excellent results secured in 1906 by the use of crude tar by employing a comparatively light refined tar. It was the express intention to apply to the roads built with this refined tar a seal-coat of asphalt as soon as need for such treatment was evidenced, thereby securing eventually the same type of road which was so eminently satisfactory in 1910.

Mechanical mixing was introduced into our work for the first time in 1912. The type of mixer employed upon practically all of the work was a cube mixer of approximately one-half cubic yard capacity fitted with a heating device. The stone was not heated previous to mixing, the heating device being employed merely for the purpose of keeping the inside of the mixer warm so that it would not become clogged. The heat was developed by a flame generated by the combustion of crude oil sprayed under pressure, and this flame entered the mixer. It is the writer's opinion that this direct flame was responsible for burning the bituminous material in several cases.

The stone employed in the mix upon the work in 1912 was both local 1½-inch stone and commercial 1⅛-inch trap rock. The results secured with the local stone averaged superior to the results with trap rock.

The results secured upon our work in 1912 were variable. In 1913 it was deemed necessary to seal-coat with asphalt approximately 42 per cent. of the total area of the roads constructed in 1912. During 1914 approximately 6 per cent. of the total area was seal-coated with asphalt. The roads which have not been seal-coated are in very good condition at present, but we anticipate the necessity for applying a seal-coat to all of them during the next two construction seasons. The seal-coating of the work done in 1912 has been very effective to date, but it is as yet too early to draw conclusions regarding the results of the 1912 work after seal-coating as compared with the results secured in 1910, where the seal-coat was applied at the time of construction.

During 1913 the amount of bituminous macadam constructed by the cold mixing method was small as compared with the amount constructed in 1912. Two methods were employed. The type of construction employed in 1910 was taken up to some extent with a refined tar in place of a crude tar—a seal-coat of asphalt being applied at the time of construction in exactly the same manner. An asphalt of characteristics similar to the asphalt employed upon experiment No. 4 at Barrington in 1909 was used to some extent in both mix and seal-coat. The work by both methods has proved perfectly satisfactory to date, although the construction is so recent that definite conclusions cannot be drawn. Trap rock was employed satisfactorily in the mix for the first time during 1913. The commercial ¾-inch size of trap rock was employed in place of the commercial 1¼-inch size which was previously used, and this product has given excellent satisfaction to date.

It has been proved in our work that the utmost care in constructing bituminous macadam by the cold mixing method is necessary. The crushed stone must be perfectly dry at the time of mixing and all stones must be perfectly covered with bitumen in order that good results may be secured. The manner of carrying out the rolling is also important in its effect upon the results obtained. It is, of course, necessary to secure by rolling as compact a mass as pos-

sible, but we have found that considerable care must be exercised in regulating the time and amount of rolling. If the weather is cool at the time of construction, we frequently postpone the heavy rolling until midday, when the maximum warmth is experienced, altho the initial rolling is done as soon after the mixture is laid as possible.

The character and sizes of the crushed stone employed are also of great importance. We have secured the best results, as far as stone is concerned, with our native rock, which is rather variable in character. As a rule our native rock is softer than trap rock and breaks with a much more irregular fracture than trap rock. There is more or less breaking of the native stone by rolling, and this appears to be beneficial rather than otherwise in that a denser pavement is secured. We feel that if trap rock is employed, smaller sizes are necessary than are necessary with a softer stone, unless there is a certainty of securing a perfect crusher-run from 1½ inch to ¼ inch or less.

We have experimented with heating the aggregate previous to mixing, but these experiments seem to show that inferior results are secured as compared with the results obtained with the same materials where the aggregate is unheated. The aggregate in bituminous macadam contains at best a large percentage of voids, and in the heated aggregate there was noted a tendency upon the part of the binder to run off from the stones, leaving only a very thin coating upon each stone. In several cases, for instance, 18 gallons of binder per cubic yard of stone were necessary to cover all stones in our unheated mineral aggregate, but when the aggregate was heated, 12 gallons would cover all the stones and there would be considerable bitumen which would run thru the mineral aggregate and be lost. The tendency for the bitumen to cover a heated aggregate very lightly seems to be due to the fact that the heat retained by the stones does not allow the binder to become hard for a considerable time, with the result that it continues to run for some time. We recognize that it is necessary to heat the aggregate in a dense mixture such as a bituminous concrete pavement affords, but in bituminous macadam work by the mixing method we prefer a cold aggregate or an aggregate heated but slightly.

The weather conditions influence the results obtained in bituminous macadam by the mixing method considerably. We have noticed that roads built late in the fall just before freezing sets in are not apt to be as satisfactory as those built in mid-summer, even though the temperature at the time of construction is not low. It seems to be a decided advantage to roads built by this method of construction to have a comparatively long period of warm weather immediately after construction in order that the surface may become freed from the top covering of stone screenings and well smoothed out before snow and ice appear. In Rhode Island we consider the season most favorable to this type of construction to be between the middle of May and the middle of October.

Upon the whole, the cold mixing method of constructing bituminous macadam as practiced in Rhode Island appears to be an economical pavement for motor vehicle traffic. It does not appear to the writer as suitable for heavy horse-drawn traffic or for a heavy mixed traffic. The traffic upon several of the trunk lines in Rhode Island consists of motor vehicle traffic to the extent of over 90 per cent. of the total amount of traffic, and it is upon these roads that we expect in the future to confine our bituminous macadam roads built by the cold mixing method. Thru large villages, where the percentage of horse-drawn traffic is large, we expect to take up a stronger method of construction.

MOTOR TRUCK FOR OILING ROADWAYS

By Frank Reed, Los Angeles, Cal.

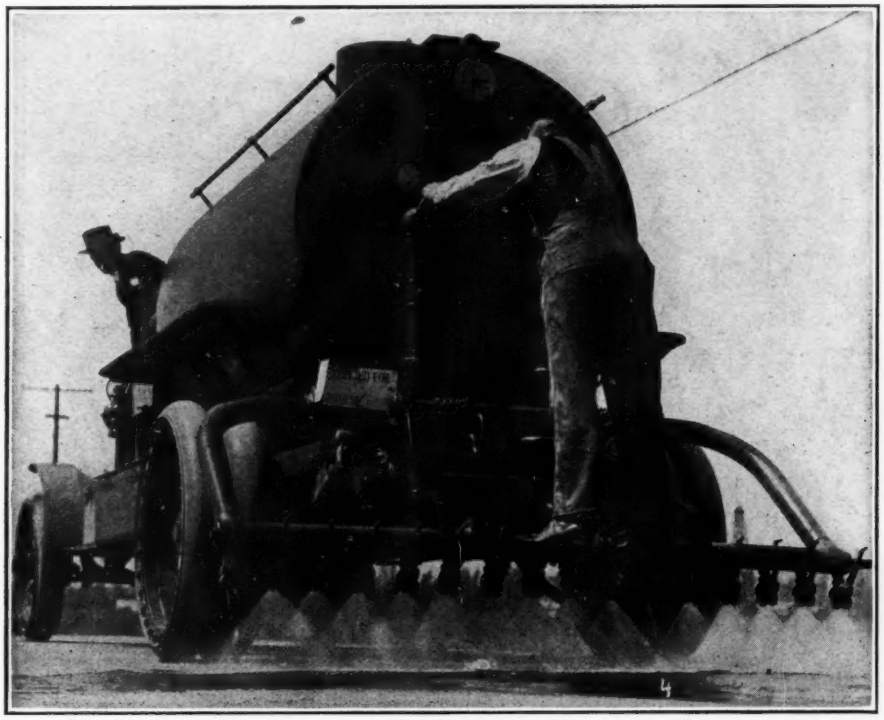
THE latest factor in standardizing all features of oil macadam highway built in the city of Pasadena, under the policy developed by T. B. Allin, commissioner of public works, is a new Peerless four-ton truck, equipped with a tank provided with all necessary special apparatus for giving efficient distribution of heavy asphaltic oil used on this type of highway.

The tank has a capacity of 950 gallons. Oil is taken in from the pit thru an opening in the top of the tank at a temperature of about 325 degrees. Magnesia heat insulation holds up the temperature without any considerable loss during the time the oil is being transported and ejected on the highway, so that it comes out of the nozzles at a temperature above 300 degrees F. Pressure at the nozzles, as indicated by the pressure gage, is maintained at 15 to 30 pounds, as required by the depth of crushed rock to be penetrated, thru the action of a rotary pump located within the tank at the forward end, and manipulation of the valves of the pipes communicating with the header which feeds the nozzles, the pipe at the left being the feeder, and the one at the right a return pipe for conducting any surplus of oil not passing thru the nozzles back into the tank. An outlet valve in the feeder pipe, within the tank, is set to operate at 50 pounds pressure, should this ever be attained. The normal intake for the pipe is located in a sump hole at the bottom of the tank. Operation of a three-way cock affords a means of taking in oil from outside the tank, thru an opening provided for the purpose to which a pipe or hose may be coupled. A float gage, the indicator of which appears at the top of the rear face of the tank, shows the amount of oil it contains. Nozzles are subject to either individual or multiple control in two banks, each four feet wide. The header may be raised or lowered by means of a lever and ratchet mechanism at the right of the operator, who also controls the friction clutch gear for throwing in and out the pump mechanism run from the transmission of the truck.

MINIMUM SPRAY, *penetration and even distribution are obtained with new Pasadena road oiling truck.*

In operation, the truck is run at first or second speed, making the full speed allowed by the governor, which, in the Peerless truck, is closely regulated. In this manner constant speed and corresponding evenness of distribution are secured, the amount of oil spread per square foot being varied at will of the operator with the pressure and speed of the truck.

An overflow pipe with its top in the dome extends vertically down thru the tank, opening below. This prevents any overflow at the rim of the dome, so that the outside of the truck is always clean,



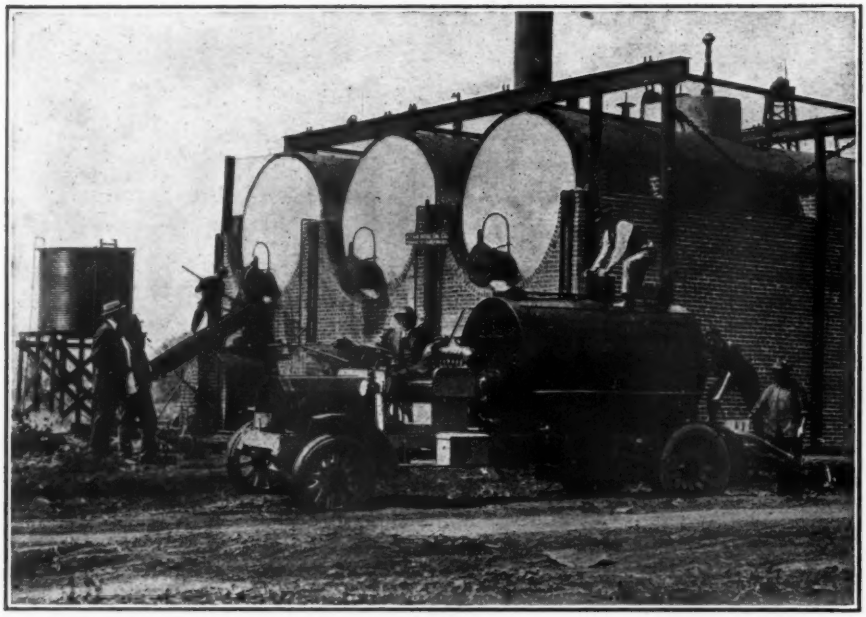
PASADENA TRUCK *spraying water on test run, showing shape and overlap of jets, and features of mechanism.*

a very important factor in a city like Pasadena, having a wealthy and critical population, and also contributing to economy of operation, as it is not only easier to keep up maintenance of a clean truck, but men take a pride in doing so.

Comparing conditions since the arrival of the truck with those existing under the system of using tanks mounted upon horse-drawn vehicles, it is found that there is better regulation of the temperature of oil, an economy of about 25 per cent. in oil due to more efficient distribution, and further economies due to obviating chances for oil cooling in the tank, while at the same time the use of the special type of nozzles which deliver the oil in a spread jet and not in a foamy spray, in connection with the steadiness of operation, gives a better penetration and absence of streaky distribution, which makes a more uniform and permanent structure.

The city of Pasadena buys its own oil upon rigid specifications and tests, and sells it to the contractors who do the road work. The truck is rented to them at $3 per hour. This figure was fixed upon as one that would be approximately correct to cover all costs of owning and operating the truck. It will be checked up by a careful record based upon a year's use, and if it needs adjustment, will be changed on the basis of experience to a figure which will afford the city reimbursement for actual costs; but it is not intended to make a profit on the truck.

The tank body is so attached that it can be removed, and in about two hours a gravel dump body installed, the dumping device to be operated from the shaft which drives the pump in the tank. The strong construction of the transmission on the truck makes it possible to drive the pump in the heavy oil while the truck is in operation. It has a 4½x6½ motor specially designed for truck use, and the item of four speeds, with the second speed twice the first, is a very important one in securing proper regulation of the quantity of oil per square foot of road.

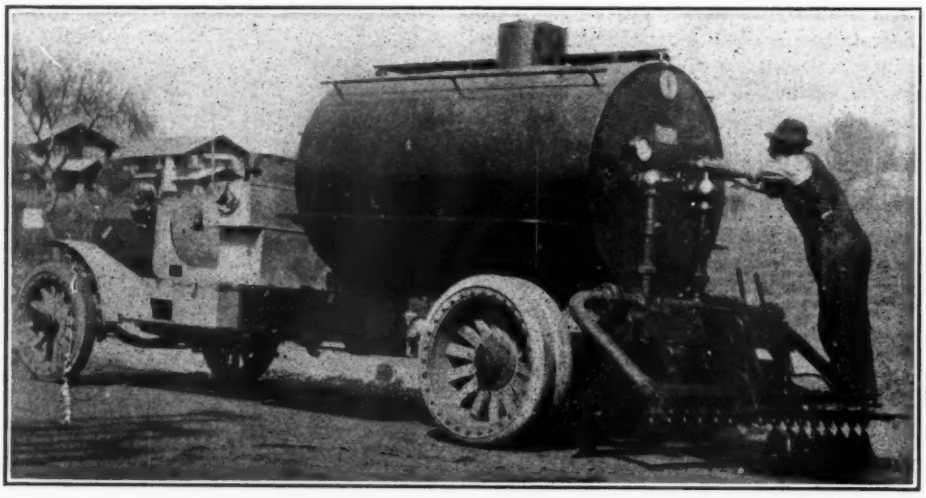


A CLEAR VIEW *of the front end, showing pump drive and arrangement whereby pump may be removed for repairs if necessary.*

Before purchasing the truck the city kept no cost data on a unit basis showing the cost of applying oil to its oil macadam highway. Figures obtained since the use of the truck indicate that there is a slight money economy in addition to the great improvement in quality of work, and the fact that the motor truck will serve three contractors in a day, while a wagon tank will serve but one.

The tank and spraying mechanism was built by Mills Iron Works, of Los Angeles, from designs by W. B. Cannon, chief road oiler of Los Angeles county, and the motor truck was supplied by Smith Bros., of Los Angeles.

CONTROL OF PRESSURE *is effected by manipulating the valves as shown in this view.*



WATER SUPPLY MAIN

FOR ATLANTIC CITY, N. J.

The Atlantic City, N. J., water works are located on the mainland, and it is necessary to pump the water thru long supply mains laid across the salt meadows and over or under the salt water channels thru them to reach the city, which is on the sandy beach of the ocean. The city has had long experience with steel, cast-iron and wood stave pipe for these mains, and this description of the latest line laid will be of interest as the result of its studies of the problem.

ATLANTIC CITY, N. J., has recently put in operation a new 48-in. water supply main which makes its water service safe and in very little danger of disturbance by accident. Formerly the city had a small cast iron supply main across the meadows, connecting with the waterworks pumping plant on the mainland near Absecon, and an old steel main, which had deteriorated to a shell of rust, so that one was inadequate and the other was in momentary danger of breakage. The only dependable main was a 48-inch wood stave pipe laid in 1910-11. It was considered unsafe to rely upon this main alone and, since investigation showed that the cast-iron pipe gave the best and most durable service, the present city administration decided to construct the new 48-inch cast-iron main which has recently been completed.

The pipe is 23,000 feet in length and 4 feet in diameter; it is of cast iron of the bell and spigot type, and its capacity is 25,000,000 gallons per day; its cost is approximately $415,000. The weight of the pipe and special castings is 8,800 tons. Eleven valves are placed at intervals thruout the length of the main, each weighing ten tons.

A new system was adopted in laying this great duct. Heretofore the mains across the meadows have been either fully or partially buried in the water-soaked soil. This is believed to have hastened deterioration, and it was decided to lay the new main above the surface of the meadows. This called for a secure foundation, which was provided by sinking piles at short intervals thruout the length of the pipe. The piles were placed in pairs and capped with cement bolsters, or beds, into which the pipe fitted. In the making of this bed 250,000 linear feet of piling was used and 3,685 cement bolsters.

One of the accompanying photographs shows the cement bolsters and the operation of lifting one of the great sections of pipe into its place, by means of a traveling crane on movable rails, which straddled the line of pipe.

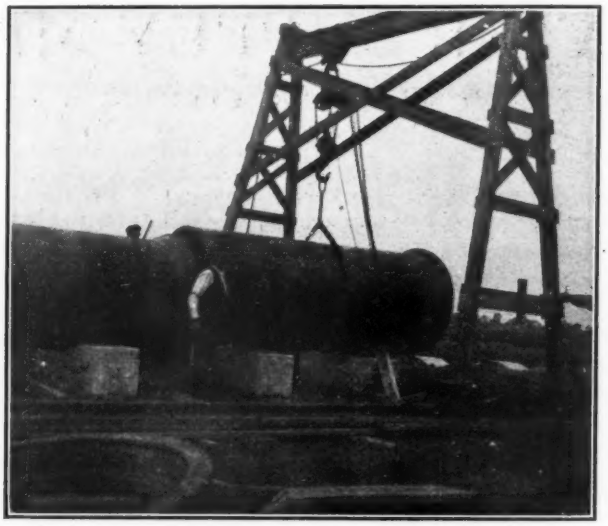
Another photograph shows the line of pipe on high cement bolsters at a crossing of one of the channels in the salt meadows, with men working on the filling of the pipe joints.

A third photograph shows the pipe on small bolsters near the ground alongside a railroad track and an anchorage pier.

The last photograph shows a section partly buried in the ground and one of the eleven valves above referred to, by means of which an injured section of the main can be shut off during repairs.

The method of construction and cost was tried out by letting first a contract for a small section of the main, 6,000 feet, which was completed in 100 days. The experience gained with this was such that the remainder of the main, 17,000 feet, was let at a considerable reduction in cost per foot, to another contractor, and was completed in 165 days.

The inverted siphon laid under the Thorofare was the most difficult part of



ATLANTIC CITY WATER MAIN. *Placing sections of 48-inch cast iron pipe in place on concrete cradles or bolsters.*

the work. At the point of crossing the tide runs about three miles an hour, and, as there is a good deal of boat traffic on the Thorofare, because of its being on the inland water route, the difficulties were greatly increased.

The specifications required sixteen lengths of pipe, a total length of 192 feet, to be laid on a horizontal plane and calked together with lead joints. It was suggested by the engineer that the ends be closed, water let in gradually, when, it was thought, the pipe would sink to the bottom to its proper position.

This method of laying the pipe was tried by the contractor, but the contained water all flowed to one end, causing that end to go down to the bottom first, and, instead of being in its proper position when laid, the pipe was to one side and the joints were badly strained.

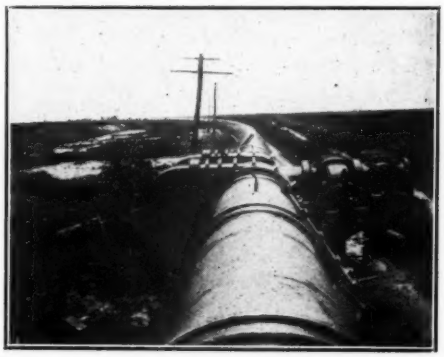
This necessitated taking the pipe up again and doing the whole work over. The contractor was very much disheartened, and was not in position to run the risk of any further loss, and transferred his contract to E. L. Bader.

Mr. Bader attempted to lay the pipe in the same manner; that is, sixteen lengths, or 192 feet, calked together with lead joints, but with guide piles driven on each side and with the extra precaution of having tackles at intervals. to prevent the pipe from going down either end first, as happened with the other contractor.

The pipe was all made up, heads put on each end, water let in and the pipe again started on its way to the bottom, but with only enough water to overcome the bouyancy of the contained air.

Before the pipe was entirely submerged a motor boat passed and the waves that

ATLANTIC CITY WATER MAIN. *Section partly buried, with one of the eleven valves which divide the 23,000 feet of pipe into sections.*

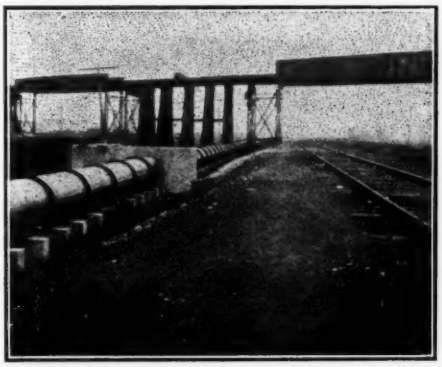


it made were just enough to again send the water to one end. This time the end did not go down to the bottom because it was held by the tackles, but the operation of lowering it had to be stopped until the pipe could again be made level.

The tremendous load then imposed was too great and the cast-iron pipe itself broke in the middle. The weight of the pipe is 750 pounds the lineal foot, making a total weight of 144,000 pounds for the pipe alone, not including the weight of the lead and the water contents.

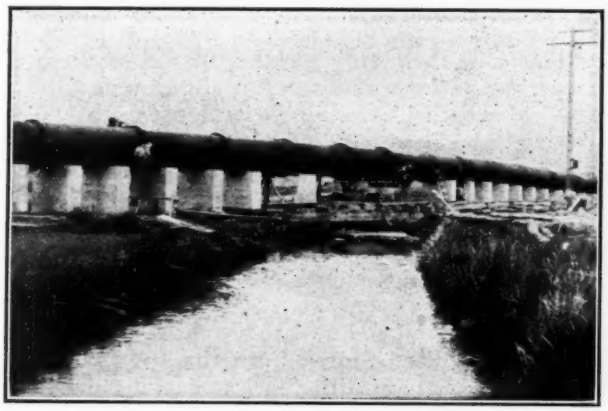
Again the pipe had to be taken up off the bottom and the job begun anew, and the conclusion was reached that it was impractical to complete the work according to the original specifications.

Instead of putting together the whole sixteen lengths, there were two sections of eight lengths each and the pipe without any heads was lowered into place with differential blocks and the joint in the middle was made by a diver at the bottom of the Thorofare.

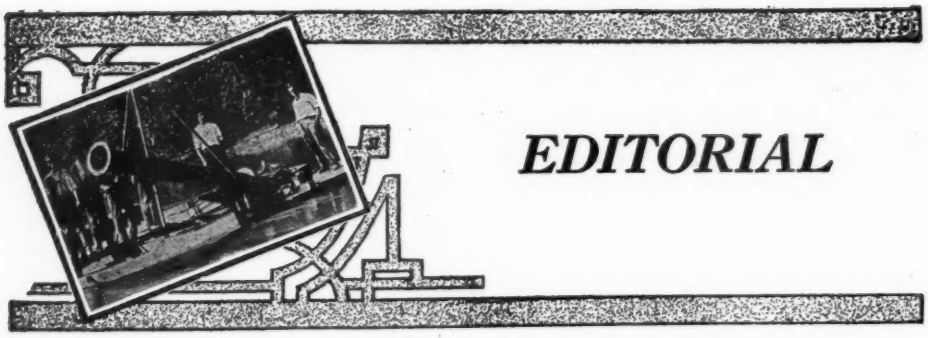


ATLANTIC CITY WATER MAIN. *Completed section of 48-inch main on low bolsters. Note concrete pier on the pipe line.*

We are indebted to W. H. Kirschman, assistant engineer in the water department, for the accompanying photographs, and to *Atlantic City Commission Government* for the data presented.



ATLANTIC CITY WATER MAIN *on high bolsters at crossing of channel in salt meadows. Men joining the pipes.*



EDITORIAL

RECOVERY IS RAPID.

Now that the first effects of the shock from the outbreak of the war have passed, the magnitude of the injury to the world's financial system can be seen more clearly, and the wonder is that the recovery has been so rapid during the past three or four months.

Unquestionably the world must suffer as a whole from the wanton destruction of so much wealth, and it has suffered in the past from the devotion of so large a proportion of its wealth to the preparation and construction of so much material and of so many engines for such destruction. It may be doubted whether the one effect is actually any greater than the other, except for the brief period after the shock of the commencement of the destruction and the consequent shattering of a large share of the world's provisions for doing business.

It is equally true that nations which are not involved in the conflict must profit by the changes in the world's business, whether they wish to or not, and that if they seize the opportunities they can profit enormously. It is likewise true that it is their duty to take up the work so wantonly abandoned by the warring nations and carry it forward for the benefit of that portion of the world which has retained its senses.

However, those who have studied ultimate causes are of opinion that the differences giving rise to the war are fundamental and must be fought to a finish, either now or later, and that this is apparently the time at which to settle for centuries the recurring conflict between the state as the object for the benefit of which all individuals exist and the state as existing for the benefit of the individuals composing it. They believe the war will be long continued.

The long lists of items of daily history which demonstrate the rapidity of the recovery of the United States from the sudden stoppage of all the ordinary methods of exchange with foreign nations need not be repeated here. It is sufficient to refer to it and to the improvement in domestic trade and manufactures, which is gathering greater force every day. The enormous contracts placed in this country by the warring nations have started some lines of manufacture ahead of the rest, but they are all following after or preparing for early resumption.

The development of new trade with the other neutral nations of the world must be a slower process, but it also is advancing with rapid strides, and the business of this country will increase in geometric ratio for many months to come.

In the field covered by MUNICIPAL ENGINEERING the improvement is marked by that in the market for municipal bonds, especially in those intended to pay for public improvements, and an equally rapid development in this field is now in sight.

It has been argued that the great demand for capital made and to be made by the governments of the warring nations to pay the expenses of the war and to rebuild their damaged public works will make interest rates high, and this argument seems to have some support from present market rates for money. But, on the other hand, it must be remembered that these same nations, and others in less degree, have been pouring vast sums into preparation for this conflict, and have been locking up vast sums in their treasuries, which are now being expended for supplies drawn from all parts of the world, and so distributed where they can again enter the channels of commerce, so that it is quite possible that the use of capital will not be charged for even at the present rates for many months. Meantime the increase in business and the probable increase in profits will make it easy to pay the extra interest demanded. This situation is relieved somewhat, so far as the United States is concerned, by the releasing of reserves effected by the installation of the new banking system, and will be further relieved by the adoption of the new basis for the currency of the nation, which is so important a feature of the new system.

MUNICIPAL GOVERNMENT

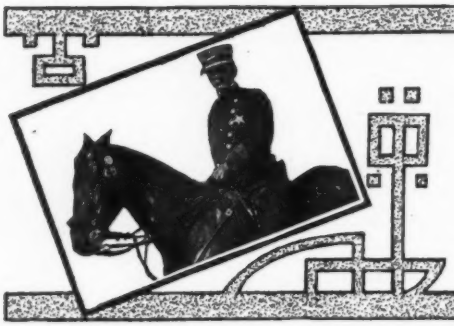
Buffalo, New York, is the largest city which has adopted the commission form of government, the vote in its favor by the citizens last month being decisive.

Where the commission form has been successful it has been largely because the cities were small and the voters could therefore be better informed regarding the qualifications of those voted for, and because the work to be done by them does not, ordinarily, demand the expert qualifications which are essential to successful administration of the concerns of large cities. The results in Buffalo in this line will be watched with interest.

It has been suggested several times in this department that one of the reasons for the success of the commission form of government has been the removal of the municipal elections as far as possible from the influence of partisan politics. This should be the aim in reforming municipal affairs and the more thoroly it has been done the more satisfactory have been the resutls.

English and German cities are governed on quite different principles. German cities are largely under home rule, excepting as to the exercise of police powers, with but little actual supervision of details by the state. English cities, on the other hand, are under close supervision of state boards which look carefully after details. But in each country the affairs of the cities are considered as business affairs not connected with the policies of state government, and city elections are mainly independent and primary, without party or group nominations.

So far as American cities have followed this principle they seem to have improved their conditions, whether they are permitted home rule or not, and whether they follow the business principles of retaining competent employes during good behavior or not, tho such experience as we have indicates that both of these lines are further leaders to improvement. Possibly the experience of a large city in the commission form will serve to separate to some extent the reasons for improvement and give us a better understanding of their action, so that there will not be so much tendency to attribute improvement to the wrong causes or to a single cause when several are involved.



QUESTION DEPARTMENT

Fittings for Playground Apparatus

We are anxious to get prices on a 4-way fitting for horizontal bar, consisting of three 2-inch pipe legs and 3-inch pipe horizontal and would like the names of those who make these fittings. K., Portland, Ore.

Good results are obtained by purchasing the specials, such as the one described, from the manufacturers, and having a pipe fitter cut the pipe and put the apparatus together. A dimensioned drawing for installation of any combination of standard set of apparatus desired will be found in MUNICIPAL ENGINEERING, vol. xliv, p. 9, January, 1913, with hints as to method of erection. Photographs of the apparatus are also given. Following are names of makers of playground apparatus, most of whom will supply the specials as well as full sets of apparatus:

Everwear Mfg. Co., Springfield, O.

Fred Medart Mfg. Co., 3550 Dekalb street, South St. Louis, Mo.

Playground Apparatus Co., 102 Main street, Toledo, O.

Geo. Howard Steel Playground Apparatus Co., Philadelphia, Pa.

International Gymnasium Supply Co., Springfield, Mass.

Harry E. Miller, 127 North Mellick avenue, Philadelphia, Pa.

Playground Apparatus Mfg. Co., Templeton, Mass.

A. G. Spalding & Bro., 125 Nassau street, New York City.

W. S. Tothill, 122 North Webster avenue, Chicago, Ill.

Municipal Conduit Systems

We have an inquiry for information on municipal conduit systems, in the United States and in Canada. Are you able to give us any data concerning such systems, or references to sources where we may obtain it? Also, can you tell us if the idea generally has been found to be a failure?
T. Chicago, Ill.

The municipal conduit for electric wires in Westfield, Mass., is described in MUNICIPAL ENGINEERING, vol. xlii, p. 220, and that in Lincoln Park, Chicago, in vol. xl., p. 443. There is a general article in vol. xlii, p. 362. The conduit systems in Auburn, N. Y., and Erie, Pa., are described in earlier numbers. These conduits are mainly of municipal ownership. There are numerous others under more or less complete municipal control. Baltimore, Md., has nearly $2,500,000 invested in its subways for pipes and wires. Utica, N. Y.; New Britain, Conn.; New Castle, Pa., are other cities having $45,000 to $60,000 invested in conduit systems.

Philadelphia, Pa.; Davenport, Iowa; San Francisco, Cal.; Grand Rapids, Mich.; Salem, Mass., are other cities with 95 to 1 mile of municipal conduits occupied at least in part by wires other than those belonging to the city. St. Joseph, Mo., and Lancaster, Pa., also have short conduits under municipal ownership.

Detroit, Mich.; Milwaukee, Wis.; Chicago, Ill.; Seattle, Wash.; New York, N. Y.; Boston, Mass.; Washington, D. C.; Cleveland, Ohio; Fall River, Mass.; Buffalo, N. Y.; Minneapolis, Minn.; Portland, Me.; Portland, Ore.; St. Louis, Mo.; Pittsburg, Pa.; Oakland, Cal.; Pueblo, Colo., are other cities owning conduits which are used entirely or almost entirely by the city alone, the first named having over 120 miles and the last four less than 1 mile each.

Chemical Periodicals

Please give a list of periodicals pertaining to chemistry and chemical analysis.
B., ———, Cal.

Following is a list of periodicals devoted to chemistry:

Western Chemist and Metallurgist, Denver, Col., $9.

American Chemical Journal, Baltimore, Md., $5.

Journal of Physical Chemistry, Ithaca, N. Y., $4.

Chemical Abstracts, Easton, Pa., $6.

Journal of Industrial and Engineering Chemistry, Easton, Pa., $6.

Journal of the American Chemical Society, Easton, Pa., $6.

Chemical Engineer, Chicago, Ill., $3.

BATHING BEACH *on lake in Washington Park, Denver, Colorado. Bathhouse is on the right of the beach.*

A Bathing Beach in Denver

Denver, Colorado, has developed a number of bathing beaches in natural and artificial bodies of water in its parks. The beach in Washington park has been developed from an old swimming hole, first by driving piles thru the ice in winter to define the safe limits of the swimming place in the lake; the piles being connected by ropes in the season. The beach was covered with sand, and piers with springboards were built out into the water. Advantage was taken of an old grove of cottonwoods for shade. Then a modern bath house with six showers and locker accommodations for 500 men and 150 women was erected. The plant is used daily by several hundred, and on Saturday and Sunday the attendance runs into the thousands. From 25 to 30 per cent. of the patrons are women and girls.

Those having their own bathing suits are charged 2 cents for towels. To rent a bathing suit a deposit of $1 must be made, and the charges are 15 cents for suit and towels, 5 cents for cap and 5 cents for stockings, if required.

Concrete Streets on Steep Grades in Mankato, Minn.

Mankato, Minn., has paved with concrete this year, fifteen blocks of residential streets, a total of 16,888 yards. The longest stretch is on Fourth street. The other pavements are on Plum, Mulberry and Washington streets, and have grades ranging up to 14.3 per cent.

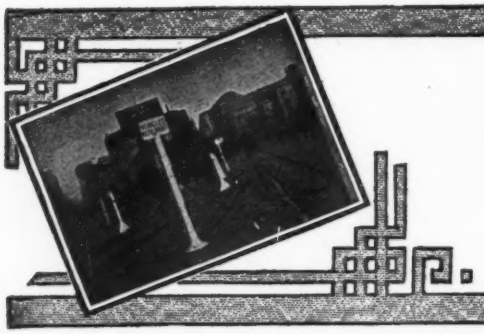
Pavements are 6 inches thick and 27 feet wide between gutters with expansion joints at 26-foot intervals. They are crowned 4½ inches at the center and 3 inches at the quarter point, giving a section that insures good drainage and a comparatively flat central portion where the traffic is heaviest.

Aggregates consisted of gravel and sand from the Minnesota and Blue Earth rivers. With a crew of 26 men the contractor was able to lay an average of 516 yards per day.

Good curing for the freshly laid concrete was afforded first by sprinkling for five hours and by covering the next morning with 2 inches of dirt which was kept wet for ten days. After twenty-one days the earth was removed, and the streets thrown open to traffic.

When paving was in progress an opportunity was afforded the contractor for doing other concrete paving work in the vicinity. Materials and machinery are at hand and both contractor and property owner profit. In Mankato five private alleys and driveways were built at the same time as the new streets. Specifications for alleys and driveways were similar to those for streets.

The Widell Co., of Mankato, was the contractor and work was in charge of H. F. Blomquist, city engineer.



WORKERS IN THE FIELD

Dayton Bond Issue Voted Down

The Editor of MUNICIPAL ENGINEERING:

Sir—The Dayton (O.) City Commission put up to the people for ratification at the election Tuesday, November 3, two bond issues, one for $250,000 to be used in buying several dumps and improving them for parks and playgrounds; the other for $1,000,000 to be used in defraying the city's share (53 per cent.) of the cost of elevating the joint tracks through the heart of the city.

About the same time the Socialist party petitioned the city commission to bring before the voters a bond issue for $500,000 to construct and operate a municipal electric light plant. The city commission turned this proposition down, believing it would be financially inexpedient to engage in the electric light business with a comparatively small plant in competition with a private corporation which is now rendering adequate service at a fairly reasonable rate, but enough signatures to demand a referendum were obtained.

At the same time the Greater Dayton Association began an active campaign for the passage of the bond issues for parks and playgrounds and grade crossing elimination and the defeat of the bond issue for the municipal lighting plant. The vote Nov. 3 had the following results:

	For.	Against.
Parks and playgrounds.....	9,784	16,931
Grade crossing elimination..	10,453	15,872
Municipal light plant.....	9,175	15,173

The one great factor in the adverse vote on the bond issues was the present business conditions and the feeling of financial stringency prevalent thruout the country. There was also sectional opposition, as some parts of the city were opposed to track elevation because the plan did not include the elimination of the grade crossings in these suburban districts. Other parts of the city were provided with parks and therefore took an independent attitude upon this question. The municipal light plant, of course, attracted a large number of voters who favor municipal ownership in any form without regard to the reasonableness of the question at hand.

The result of the vote puts the present administration in a better position than it was previous to the election, inasmuch as there has been considerable agitation for track elevation and parks and playgrounds, and now all responsibility for failure to secure these things has been placed upon the people at large. There would undoubtedly have been criticism of the city administration if these questions had not been put before the voters at this time.

S. H. ANKENEY,
Publicity Manager,
The Greater Dayton Association,
Dayton, Ohio.

A Septic Tank for Small Communities

The Editor of MUNICIPAL ENGINEERING:

Sir—The need for sewage disposal increases yearly and small communities are becoming more and more impressed with the necessity of disposing of household and industrial wastes. With the idea of co-operation in the matter, we offer the following plan of a septic tank for small communities.

The tank is constructed entirely of concrete, and is divided into two compartments by a concrete wall running lengthwise thru it. A series of baffles are constructed as shown (Fig. 1) numbered 2, 3, 6 and 7, making an angle of 110 degrees with the concrete walls in the direction of flow. The tops of the baffles are one foot above the flow line and hence serve also as scum boards. The purpose of the baffles is to check the rate of flow of the sewage thru the tank, and they should not make angles of less than 90 degrees with the walls because of the tendency to produce eddies, which would thereby defeat the purpose of the tank.

The bottom of the tank is made to slope gradually (6 inches in 50 feet), being deeper at the inlet than at the outlet. This facilitates the concentration of the

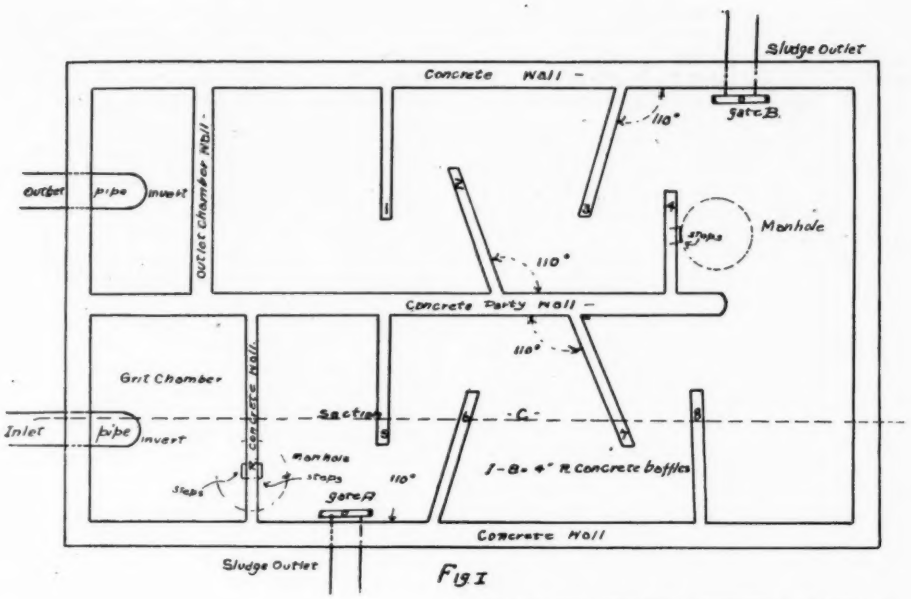


Fig 1

PLAN OF SMALL SEPTIC TANK *for village or large institution, taken at Section C in drawing below.*

VERTICAL LONGITUDINAL SECTION *of small septic tank for village or large institution, taken on the line marked "Section C" in the plan above.*

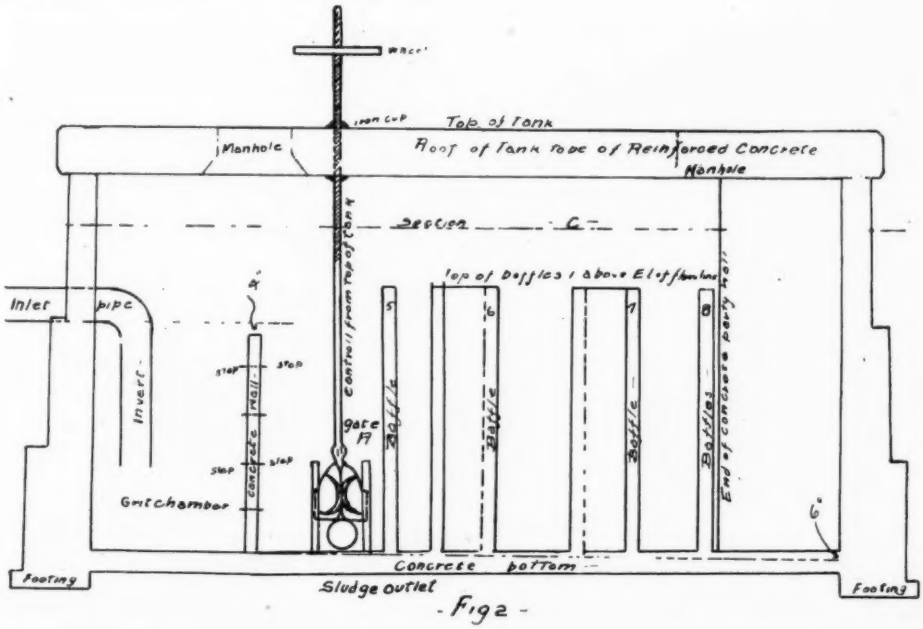


Fig 2

sludge in two places, and it may then be run into a concrete pit below the tank thru the gates A and B, which are controlled from the roof by hand wheels. The roof is constructed of reinforced concrete.

The sewage, after being screened, passes thru the inlet pipe into the grit chamber, thence over the grit chamber wall, thru the tank around the baffles and out thru the outlet pipe to the filtration beds.

EDWARD J. KELLY AND JESSE WATTS,
245 Union Ave.,
Mt. Vernon, N. Y.

Vicksburg's Water Works Situation

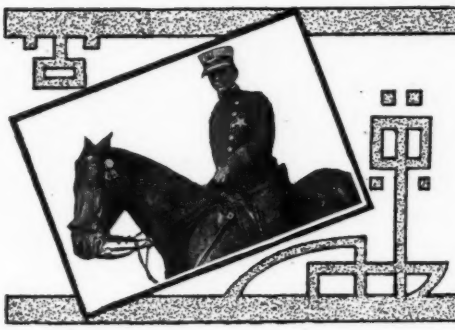
The city of Vicksburg, Miss., has been having a rather long controversy with the Vicksburg Water Works Company over its water works plant and has made several plans and specifications for a plant to be built and owned by the city and put in operation when the water works company's franchise expires with 1916. The latest move of the city was to receive bids for the construction of a plant on plans and specifications which seem to have been trimmed to bring the cost as near as possible to the $400,000 fund on hand from the sale of bonds. The bids were received on September 12, 1914, and were published October 24, and the total cost of the new city plant ascertained from them is reported to be $450,429.65.

The water company has issued a pamphlet in which it compares its own plant, as it exists, with the proposed new plant, especially as to points in which the new plant would be inferior to the old plant and as to items of cost not included in the bids, with the purpose of showing the advantages of purchasing its plant at its present offer of $340,000.

The controversy seems to have reached a very unfortunate stage and to be one which could be amicably and equitably settled if the parties to it would agree to submit the question of the value of the company's plant to a board of competent and unbiased engineers, so that the merits of both sides might be determined accurately and completely and without influence of bias or prejudice. If this were done, and the judgment of the experts was not rejected on account of official prejudice, it would not take long to settle the question in the way most equitable for all concerned.

A New York Public Comfort Station

The accompanying photograph shows one of the public comfort stations in Manhattan, New York City, and the care exercised in their design and construction. This station is located on Forty-second street, adjacent to the Public Library, the large building seen in part in the background. As a consequence of this location the station must be elaborate in design and excellent in construction sufficiently to conform with the magnificent structure with which it is connected. That the city has taken full care of these points is shown by the photograph.



LEGAL DECISIONS

Rochester Can Specify Bitulithic

The injunction restraining the city of Rochester from letting the contract for a bitulithic pavement in Culver road from East avenue to the canal bridge is dissolved in a decision filed by Supreme Court Justice W. W. Clark, October 28.

The real question at issue is whether there can be any competitive bidding, as the city charter requires, when bitulithic is used as the paving material. This material is a patented article, manufactured by one company, Warren Brothers, of Boston, and the Whitmore Company alleged that because of this fact there could be no competition. Justice Clark takes a different view. He says that the owners of the patent opened the way for competitive bidding when they offered the uses of their patented product at a fixed price to any contractor who desired to bid on the whole.

"The adoption of specifications for a patent pavement does not prevent competitive bidding and that proposition has been decided many times and in many states," says Justice Clark in his decision. "There is nothing in the charter of the city of Rochester which prohibits the common council from adopting bitulithic pavement for a street improvement, if that was desirable, and there is nothing in the charter which would preclude property owners from designating bitulithic if that was the pavement which seemed to them most desirable, and there is likewise nothing in the charter of the city of Rochester which prohibits the authorities from using for such an improvement a patented article.

"The bitulithic pavement," continues the court, "which was desired by the property owners who were to pay for the improvement and which was adopted by the city authorities, and for the construction of which they invited bids, is a kind of product or patent pavement covered by perfectly valid letters patent. It is not merely a certain make, style or brand of material; and in adopting bitulithic pavement for the improvement in question the principle of competitive bidding was not destroyed but was distinctly preserved in this transaction, as is shown by the fact that there were a number of bids submitted in good faith, and the contract was awarded to the lowest bidder, even as against the owner of the patented article."

Sections 115 and 230 of the charter of the city of Rochester provide that, "A majority of the property owners liable to be assessed for the cost of paving or repaving a public street, highway or place, owning not less than two-fifths of the feet front of property * * * may at any time within one week after the ordinance for the improvement takes effect present to the board of contract and supply a petition or other writing, designating one of the materials specified by the common council as the material to be used in constructing the pavement, but may not designate therein any particular kind, make, style or brand of material."

Decisions of the Higher Courts of Interest to Municipalities

City Must Have Charter Authority to Borrow Money—The power to borrow money and incur indebtedness is not an incident to the governmental powers of municipal corporations, and cannot be exercised unless conferred by the charter. Merchants Loan and Trust Co. v. City of Chicago, (Ill.) 105 N. E., 726.

Cost of Water Mains May Be Refunded to Property Owners—In view of local improvement act, sec. I (Hurd's Rev. St. 1913, ch. 24, sec. 507), providing that municipalities may construct local improvements by special assessment, by special taxation of contiguous property, by general taxation, or as otherwise provided by ordinance, sec. 4, declaring that when any city shall provide for the making of any local improvement the same ordinance shall prescribe whether it shall be made by special assessment or special taxation of contiguous property, or general taxation, or both, does not restrict the municipality to the modes specified, and hence a municipality may pay for the

laying of water mains with money furnished by abutting owners and provide for reimbursement of such owners, with interest out of the general revenue from the mains. Idem.

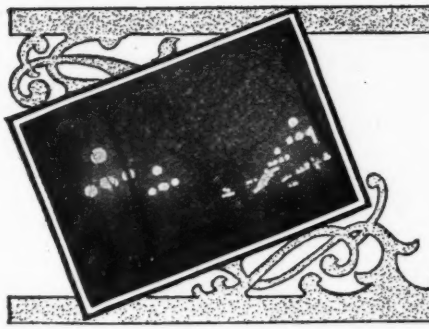
Taxing Railroad for Street Improvement—Where land of a railroad company is used only for its tracks used in transportation, there is no enhanced value of the land from the improvement of an adjoining street by the construction of a tile subdrain on each side of the street and a storm sewer on part of the street, and the land cannot be taxed for benefits therefor. Where a part of a railroad right of way adjoining a street improved by the construction of a tile subdrain and a storm sewer is not benefited thereby, while another part devoted to business uses is benefited, it is not improper to tax the whole right of way in the amount of the benefit instead of dividing the right of way in levying the tax for benefits. City of Kankakee v. Illinois Central Railroad Co. (Ill.) 105 N. E., 731.

City Liable for Neglect of Contractor.—A municipality can avoid liability for negligence of an independent contractor in the construction of a public work unless the matter involved is one of positive duty to an individual and in its nature nondelegable or the work is intrinsically dangerous or liable to create a nuisance, in which case it is liable, and the duty cannot be evaded or cast upon others. A municipal corporation is under no obligation to keep a navigable river within its territory free from obstructions. Where a bridge across a navigable river within the limits of a municipality was removed and a new one constructed by independent contractors, under permission from the War Department to the city, a positive duty was placed upon the city to keep the river free from obstructions in the performance of the work, which duty could not be delegated to the independent contractors. Hosford Transp. Co. v. City of Portland (Ore), 141 Pac. 1016.

City Liable for Injury from Tipping of Catch Basin Cover.—An iron lid over an opening in the covering of a surface water drain maintained by a city between the curb and sidewalk space, near the intersection of streets, where street cars stopped and those waiting for cars would stop and were liable to stand, having for a long time been in such condition that it would tip when one would step on it, the city was charged with notice, making it liable for injury to one from its tipping when she stepped on it while so waiting for a car. Rickards v. Kansas City (Mo.), 168 S. W. 845.

Liability for Damage by Pollution of Stream by Septic Tank Effluent.—Where a sewer improvement district constructed a sewer and a septic tank, in which the sewage was chemically treated under a plan contemplating the discharge of the sewage, after being treated, into a stream, the district, and not the city, was liable for the damages of a riparian owner caused by discharging the sewage into the stream, tho the city after the completion of the sewer had control thereof; such damages being an incident to the construction of the sewer. City of El Dorado et al. v. Scruggs (Ark), 168 S. W. 846.

Water Company's Franchise Annulled.—Complainant city (then town) in 1892 by ordinance granted a franchise for fifty years to defendant and others, whose interests he afterwards acquired, to construct and maintain waterworks to supply the town and its inhabitants with water "to be conveyed from creeks * * * known as Mink and Gibson Jack creeks," and to be in quantity sufficient to supply both the public and private uses of the citizens of the town and of pure and healthful quality. Afterwards rates were agreed upon and established. In 1901, the town having become a city and largely increased in population, an ordinance was passed reciting that, the then supply of water having become inadequate, defendant agreed "to bring in the waters of Mink creek" and to make all extensions warranted by the growth of the city, involving a large expenditure of money, in consideration of which the city confirmed the previous grant, agreed to rent a certain number of additional hydrants, that the prevailing rates should not be changed for five years, and only at intervals of five years thereafter, and then only on specified conditions, and that the city would not grant a more favorable franchise to another nor own a water system of its own until it had offered to purchase defendant's system at a price to be fixed as therein provided. The ordinance was accepted by defendant. The bill alleged, and the proof showed, that defendant had brought in but a small part of the waters of Mink creek, had failed to make the required extensions or to keep existing pipes in repair; that, on the contrary, he had reduced the supply by making regulations restricting the use of water and placing "reducers" in the supply pipes to the extent of preventing the city from obtaining water for street sprinkling or fire protection and the inhabitants for domestic purposes, to the injury of their health and property. Held, That such ordinance required defendant to bring in all the waters of Mink creek as well as to make the specified extensions, for which he received consideration in the concessions made by the city, and that, on the facts shown, the city was entitled to a decree annulling the ordinance. Murray v. City of Pocatello (Ida.), 214 Fed. 214.



WATER

Water Works Improvements at Toledo, Ohio

The more important improvements which have been made in connection with the Toledo water supply include the installation of a 30,000,000-gallon pump in a new fireproof section of the pumping station and the rewiring of the pumping station; bids have recently been received for two new 500-h.p. boilers and it is planned to make cross-connections between the force mains outside the pumping station early in 1915.

A filter plant has been installed two miles above the pumping station, with three 15,000,000-gallon and one 5,000,000-gallon low-lift pumps, thirty-four mechanical filters, each of 1,000,000 gallons capacity, a 5,000,000-gallon clear water basin and, at the pumping station, a 15,000,000-gallon suction reservoir.

The complete installation of the distribution system and hydrants for a separate high pressure system with two temporary connections to the general system, and the setting of additional low pressure hydrants in the congested value district, have recently been accomplished. The separate high pressure system practically covers the area north of the river, bounded by Washington, Michigan, Jackson, Superior and Cherry streets, and is made up principally of 10-inch pipe, with a 12-inch cross-feeder and 16-inch main supply line. The site for a high pressure pumping station at the foot of Cherry street has been purchased and bonds have recently been sold for proceeding at once with the erection of the building. Important mains that have been laid or are being laid include: A 30-inch along Whitney, Detroit and Central avenues from Cancroft to Fulton streets, a 24-inch from the pumping station across the river to the southerly end of an 8-inch line on Oak street, East Toledo, a 24-inch on Erie street from Mulberry street to Buffalo street, an extension of the 12-inch on South Broadway to the city limits, 12-inch on Washington street from Erie street to St. Clair street and a 12-inch from Front street east on Kelsey avenue, East Toledo; it is planned to lay a 30-inch main in Cherry street from Erie street to Central avenue before the end of the present year and several 12 to 24-inch extensions are contemplated in 1915. Until the 30-inch contemplated for 1915 is installed, the mains already laid will have very little effect on supply to the congested value district.

In the fire department, the total membership has been increased from 201 to 234, with a fire force of 222; a combined engine and ladder company established at Detroit avenue and Nessle street; Engines 2, 3, 5 and 8 equipped with tractors and Engine 7 mounted on an automobile chassis; automobile combination hose wagons provided for Engines 3 and 7, an automobile aerial ladder truck put in service at headquarters and an automobile city service truck in Engine 7. Trucks of the latter type are about to be installed with Engines 3 and 5.

The removal of the fire alarm headquarters to a fireproof building is of vital importance. The present headquarters building is obviously in danger of collapse and has been condemned as unsafe for occupancy by state and local authorities; it contains large quantities of highly combustible materials used in occupancy and construction, with serious exposures from surrounding buildings. The possibilities of serious interruption, leaving the entire city without fire alarm protection, are most alarming. The site for a new building has been decided upon, but no other definite steps have yet been taken.

Regulation of Water Rates

The ordinance granting a water supply franchise to the Pocatello Water Company, of Pocatello, Idaho, has the following provisions regarding determination of rates for service at regular intervals of time and for determination of value of plant for purchase by the city:

Sec. 3. The foregoing rates and charges are hereby adopted by the city of Pocatello, by and for itself, and as trustees for

the use and benefit of all private consumers of water within the corporate limits of said city for a period of five years from and after the passage and approval of this ordinance. At the expiration of said time, if the earnings of said water system shall exceed five per cent. above reasonable expenses upon the value of said water system as then agreed upon, or as may be ascertained as hereinafter provided, then the rates as set forth in the "Schedule of Water Rates" of section two of this ordinance may be readjusted so as to yield not less than five per cent. above reasonable expenses on the valuation, but no readjustment shall hereafter be made that will yield less than five per cent. above reasonable expenses, on the value of the investment ascertained as hereinafter provided for in section four.

Sec. 4. If, at the expiration of five years, or at any time thereafter, it should be deemed necessary to readjust rates under the provisions of section three, and if the city of Pocatello and the said James A. Murray, or his successors or assigns, cannot agree upon the value of said water system, for the purpose of such readjustment, then the value of said water system shall be ascertained and determined in the following manner, to-wit: A committee of four experienced and disinterested hydraulic engineers who must be members of the American Society of Civil Engineers, shall be selected, two by the city of Pocatello, and two by said James A. Murray, or his successors or assigns, and the following questions shall be submitted to them: For what sum can the water system of James A. Murray be now duplicated? If a majority of the four cannot agree they shall elect a fifth, and if they cannot agree upon a fifth, they shall request the president of the American Society of Civil Engineers to appoint a fifth member. The decision of a majority of the committee so selected shall fix the value of said water system for the purpose of readjusting said rates and such decision shall be final.

Sec. 5. The city of Pocatello shall not hereafter grant to an individual, corporation or association any terms or franchises for the construction or operation of a water system more favorable than the terms and franchises now held, confirmed and continued in said James A. Murray; nor shall the city of Pocatello build, acquire, own or operate a water system of its own, until it has in good faith offered to purchase the water system of the said James A. Murray, or his successors or assigns, at a price to be ascertained as follows: If the owners of said water system and the city of Pocatello cannot agree upon the price then a committee of experienced and disinterested hydraulic engineers, who must be members of the American Society of Civil Engineers, shall be selected in the manner set forth in section four of this ordinance, who shall fix the value of said water system for the purpose of such sale, and the decision of a majority of such committee shall be final. At intervals of five years from the approval of this ordinance and during the period of ninety days immediately following the completion of each five year interval, the city may purchase the water system of the said James A. Murray or his successor or assigns, under the conditions specified in this section, but at no other time except by mutual consent of the city and the owner of the said water system. In fixing the value of said water system, whether for the purpose of selling or of readjusting rates, the water system of the said James A. Murray, or his successors or assigns, shall be held to mean and include all of the pipes, mains, hydrants, conduits, ditches, reservoirs, dams, water rights, rights of way, natural and acquired advantages, franchises, implements, storage grounds, material on hand, and all rights and property of what kind soever, either in use or on hand and belonging to the said James A. Murray, in his capacity of furnishing water for any and all purposes to himself and to his customers, at Pocatello, Idaho, saving and excepting account books, and records; and each article of property aforesaid shall be separately considered and evaluated by said committee, and in the event of the city of Pocatello purchasing said water system under this ordinance, said James A. Murray shall transfer all his rights, title and interest in and to said property to said city, and the said city shall receive and pay for the whole plant as aforesaid, the said James A. Murray stepping out, and leaving all said property undisturbed and ready for the city to step in.

Limitations of Water Filters

By George W. Fuller, Consulitng Engineer, New York City, before the American Society of Municipal Improvements.

The treatment of water supplies, in order to secure water of proper sanitary quality, in connection with the treatment of sewage affecting these supplies, is one of the great questions of the day in its bearing on public finances. These two subjects are closely related, and, due to the large financial outlay necessary to obtain required results, their correlative value and efficacy should be closely studied.

Most American cities have available within their reach a source of water supply still capable of purification by the ordinary modern methods of filtration and

sterilization. The growing demand for public improvements in recent years has amply demonstrated that the public treasury is not inexhaustible, many large cities having already closely approached their legitimate bonding power.

As would logically follow, centers of population have resorted, and do resort, to the cheapest and quickest method of obtaining the required sanitary results, namely, the purification of the amount of water that they need for their own use, rather than the more expensive and possibly illogical method of treating all sewage on the water-shed in the hope that the supply may be maintained of sufficient purity to avoid special treatment. This is a logical, economic development, and altho selfish in its basic elements will probably prevail as long as it produces the required results and until the present methods of water purification fail. When the sanitary and aesthetic limitations of water purification have been reached, and it becomes necessary to eliminate by this or some other treatment the sources of pollution from the water, the public policy of handling the question must change accordingly.

The prevention of the pollution of large water supplies, which still retain great reserve capacity for dilution, does not seem to warrant either the close study or immediate financial outlay that the treatment by modern methods of the water supplies drawn therefrom, warrants.

Commendable as is the prevention of water pollution, nevertheless immediate results are demanded. The difficulties, financial and otherwise, of cleaning up all water-sheds on short notice, or even of permanently maintaining this condition on long notice, are apparent, but the possibility of purifying all water supplies is a much more tangible proposition. Therefore, the method before mentioned promises the greatest sanitary efficiency, in the absence of sufficient funds to accomplish both results. It is not to be presumed that sewage purification should be abandoned, but rather that it should be a subsequent development, taking place when conditions would indicate that purification of the water supply was becoming a difficult problem, with reasonable possibility of failure.

As an eminent American engineer once said, "It is better to pay one dollar for water purification than ten dollars for sewage purification, when commensurate values are considered."

In the purification of water supplies, the question of pollution, studied in connection with modern laboratory reports thereon, might be classified under three heads:

Total Bacterial Pollution.—Considered on the basis of total bacterial content present, regardless of their identity.

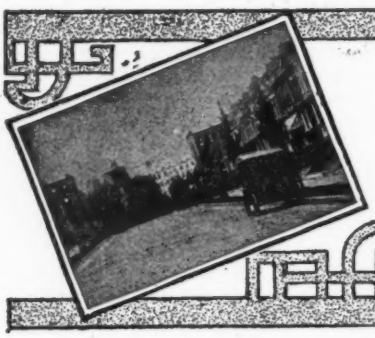
Sanitary Pollution.—May be outlined as the presence of bacteria or other organic matter foreign to water, without specific reference to the presence of pathogenic organisms and generally arrived at by the determination of B. Coli or some other specific organism.

Pathogenic Pollution.—The presence of disease-producing organisms, the removal and destruction of which is the real function of water purification.

The methods of isolation and identification of pathogenic organisms by modern laboratory methods are entirely inadequate to meet the practical requirements of the case. The total bacterial count is of little or no diagnostic value, and it has become customary to determine what is therein designated as sanitary pollution by a general identification of some associate bacteria, which must arrive at their destination by the same routes as would be followed by the pathogenic or indicative disease-producing organisms. The presence of the colon group is assumed to indicate that the route of contamination is open. Modern practice tends more to the prevention of sanitary pollution than to the consideration of the total bacterial content of a given water. Studies apparently indicate that there is no necessary relation between total bacterial content and the B. coli content. However, a high degree of efficiency in decrease of bacterial content by a filter generally means a corresponding high reduction in coli content.

The establishment of arbitrary limitations to the satisfactory efficiency of water purification, measured and defined according to the coli content of the raw water, must always be considered and applied with reference to the special circumstances attendant on each case, especially if the attainment of that limiting coli content in raw water implies as a resultant conclusion therefrom, that sewage treatment on the water-shed has then become necessary, in conjunction with filtration, in order to secure a proper water.

There are large cities where the coli content of the raw water greatly exceeds 500 per 100 cubic centimeters; nevertheless, this water is successfully and satisfactorily treated by modern methods of filtration and sterilization. In fact, there are large sections of this country where raw water, coming within the limitations above defined, is not available, but which water, nevertheless, responds readily to modern treatment.



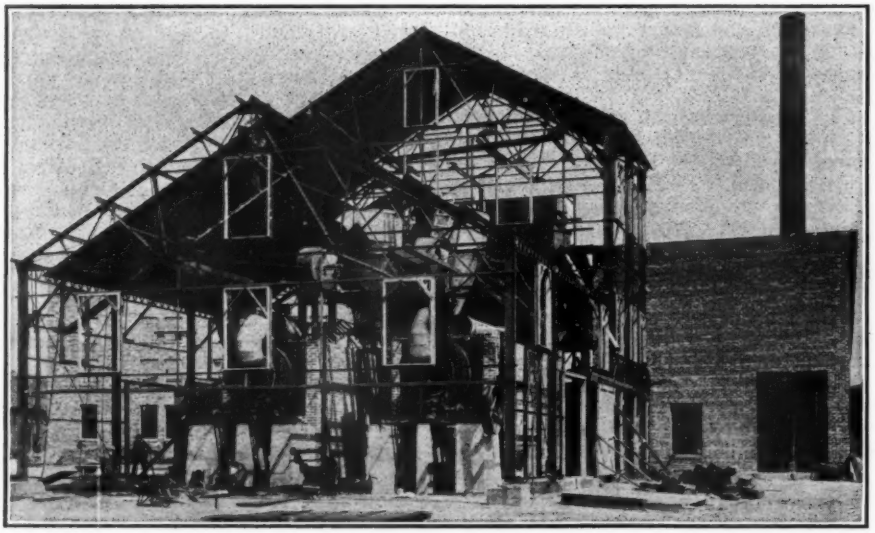
ROADS AND PAVEMENTS

New Municipal Asphalt Plant at Pittsburg, Pa.

By Norman S. Sprague, Superintendent of Construction, Department of Public Works.

A new municipal asphalt plant, known as the North Side plant, has recently been completed and placed in operation in Pittsburgh, Pa. For some years asphalt resurfacing and repair work has been done by the city and recently the city adopted the policy of doing all asphalt paving work, with the exception of original improvements on streets paid for by assessment of property owners. Since the destruction of the old North Side plant by fire some years ago, the work has been handled by a single municipal plant located in the East End district of the city. The length of haul to the North Side district was excessive and this, together with the over-taxing of the capacity of the East End plant necessitated the construction of an additional plant, which is described herein.

The new plant is centrally located, with respect to that part of the city north of the Allegheny and Ohio rivers. The selection of the site was influenced by the desirability, on the score of economy, of having facilities for delivery of material both by river and by railroad. The site selected lies between the bank of the Ohio river and the tracks of the Pittsburgh & Western railroad, so that excellent facilities are afforded for the delivery of materials to the plant. Recently the city has adopted improved specifications for sheet asphalt paving, requiring a better sand grading and the mixture of fine sand imported from the lakes, to the extent of about 25 per cent. of the sand used. All materials, including the lake sand, will be delivered to the new plant by rail, except



PITTSBURG'S ASPHALT PLANT *for North Side, during construction, showing sand and stone dryers in place, and building under erection.*

PITTSBURG'S ASPHALT PLANT *for North Side, in operation. Sand and stone bins are seen above, discharging into mixers beneath them; tops of asphalt tanks in foreground.*

the local sand, which is dredged from the river in the vicinity of the city, and which will be received by barge.

The plant consists of a structural steel building housing driers, mixers and other equipment; a brick boiler and engine house; a switch track leading from the tracks of the Pittsburgh & Western railroad; a crane track, upon which is operated a locomotive crane with a 40-foot boom for the unloading of materials received by railroad; a dock on the river bank, where there is provision for a hoist of the locomotive crane type, with a 60-foot boom; storage bins from which materials for feeding the dryers are drawn. To date the plant has been completed with the exception of the dock, dock hoist and storage bins.

A contract for the plant was awarded under general specifications, accompanied by a plan of the site and a general arrangement drawing. The essential features of the specifications and contract were as follows:

(a) The contractor to design and build a plant in conformance with the specifications and general arrangement plan. Latitude was allowed the contractor with respect to general arrangement of plant and equipment, the contract providing that the contractor was not required to adopt the arrangement as shown in the general plan, provided an equivalent or better plan was devised and which would meet the general conditions of construction and operation. With regard to latitude in equipment and apparatus, the specifications stated the following:

"Bidders will be allowed sufficient latitude in submitting their designs and specifications for the various units of the plant, apparatus and appurtenances herein required so as to adapt their designs to the standard makes of such equipment, providing the requirements of these specifications are fully complied with and neither the efficiency or capacity of the plant are impaired in any manner."

(b) The capacity of the plant to be 2,000 square yards of completed asphalt pavement in a 10-hour working day, same to consist of wearing surface 2 inches in thickness and a binder 1 inch in thickness, or an equivalent of asphaltic concrete.

(c) The requirements as to the delivery of materials are stated and the contractor required to conform thereto.

(d) The specifications give the type, material, construction and capacity of the various units of the installation.

(e) The work excluded from the contract and which the city has done itself, includes the following: Grading of the site, excavation for foundation, concrete foundations for building and equipment, water, sewer and gas connections outside of building, paving of first floor of building and driveways, crane hoists, dock and bins outside of building, switch tracks and a few other minor exceptions.

The following are the principal features of the plant: A steel frame building, 88.5 by 42 feet, with corrugated sides and roof; a one-story brick boiler and engine house 30 by 30 feet; a 150-h.p. horizontal tubular boiler, fired with gas; 125-h.p. high speed automatic cut-off, self-contained steam engine; plant is belt-driven; there are two driers of the rotary type, brick encased, having a required capacity of 20 tons and a rated capacity of 25 tons each per hour of sand containing 7 per cent., or less, moisture; three melting kettles each with a capacity of 14 tons of asphalt; steam coils are electrically welded; two air compressors; asphalt discharge pipes and pressure tanks are steam jacketed; two 15-foot mixers and one 12,000-gallon flux tank with suitable coils.

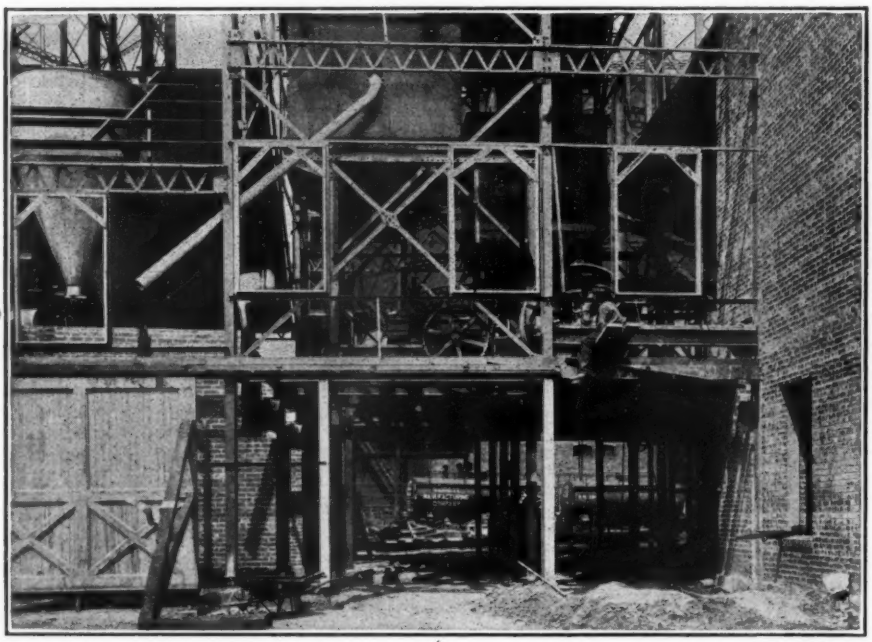
PITTSBURG'S ASPHALT PLANT *for North Side, during construction. Bins for sand and stone above; mixers on second floor; driveways under mixers, where wagons receive their loads of asphalt mixture.*

The material handling equipment includes two hot-material elevators, one for each drier; 2 hot-material bins with suitable partitions and each of 15 tons capacity; dust elevator, platform elevator, 350-gallon flux-weighing tank; four weighing buckets for sand, dust and stone, and two asphalt weighing buckets.

Flexibility in operation, which is highly desirable in a plant of this kind to meet demands from day to day, is obtained by the arrangement of driers, elevators, bins and chutes, which permits of operating either drier with either mixer. One of the driers is to be operated for the greater part of the time on binder stone and asphaltic concrete, while the other will be used principally for wearing surface. The system of chutes and by-passes, however, permits of the operation of both mixers on wearing surface when one of the bins is filled with materials for binder or asphaltic concrete.

The contract was formally awarded April 14, 1914, to the F. D. Cummer & Son Company, of Cleveland, Ohio, and the plant was completed and placed in operation September 25, 1914. The cost of the plant to date and the estimated cost when fully completed follows:

Contract for construction and equipment of plant	$28,900.00
Grading of site	4,000.00
Foundations, piers and sewer connection	1,000.00
Gas and water connections	425.78
Locomotive crane	4,850.00



PITTSBURG'S ASPHALT PLANT *for North Side, completed, looking south. Stone and sand storage in foreground with portable crane unloader. This is the same end shown in the first photograph.*

Switch and crane tracks.....	950.00
Total cost of completed work..	$40,125.78
Estimated cost of future work:	
Storage bins	$ 2,500.00
Dock	2,900.00
Dock hoist	5,500.00
Office building	2,000.00
Total	$12,900.00
Total estimated cost of plant when fully completed	$53,025.78

Plans are now under way for the construction of the proposed dock and hoist at the river and for the storage bins. The latter will consist of three bins, each of 50 tons capacity, for the handling of broken stone, river sand and imported sand. The materials will be drawn from the bins in the correct proportions into a hopper car and pushed by hand to the bucket conveyors feeding the driers. This will make it possible to obtain exact proportioning of lake and river sand and thus insure uniformity of results.

The plant has been designed and erected under the supervision of Robert Swan, director of the department of public works, and N. S. Sprague, superintendent of the bureau of engineering, Tom M. Reed, division engineer, and James D. Strain, superintendent of asphalt plants.

Increase in Asphalt Production

Altho there was a decrease in the production of natural asphalt in the United States in 1913, including all the varieties of natural asphalt and asphaltic sandstone and limestone, there was a far greater corresponding increase in the output of manufactured or oil asphalt, according to the United States Geological Survey. Oil asphalt obtained as a residue from the distillation of Mexican, Gulf, and California asphaltic oils, and even from those of the Middle West, is becoming more and more available. There is correspondingly less interest in the development of new sources of natural asphalt.

The production of natural asphalt in 1913 amounted to 92,604 short tons, valued at $750,713, a decrease from 95,166 short tons, valued at $865,225, in 1912. On the other hand, the output of manufactured or oil asphalt in 1913 was 436,586 short tons, valued at $4,531,657, against 354,344 short tons in 1912, valued at $3,755,506. The total quantity of asphalt imported into the United States for consumption in 1913 was 228,178 short tons, valued at $910,611. The island of Trinidad furnished the greater part of this, 125,273 short tons.

Asphaltic Materials for Road Construction

By Alfred A. Berkowitz, Sheffield Scientific School, Yale University.

From a prize essay in the recent competition held by the Barber Asphalt Paving Co. the following extract is made, giving the points of major interest in its discussion of the selection of asphaltic materials for road construction.

To specify an asphalt by its chemical or its physical properties alone is not enough. The chemical properties of two asphalts might be the same, while physically they differed markedly. Moreover, a relationship exists among certain properties, and there is danger of assigning limtations to the several properties covered in a given specification without considering the effect of each limitation upon the other properties included. For instance, the higher the ductility required of an asphalt the more susceptible it is to change in temperature.

Furthermore, the engineer cannot be governed entirely by theoretical considerations, but must keep in mind the ability of the manufacturers to meet his requirements. He should avoid making requirements that are superfluous, inconsistent, unnecessarily increase the cost, or sometimes even impossible to carry out. Numerous instances can be cited where the combinations of properties required have not existed in any commercial material. These impossible requirements usually result when the engineer selects clauses here and there from several other specifications which he knows have given satisfaction.

With a view toward remedying this evil, the American Society of Civil Engineers, the American Society for Testing Materials, etc., have prepared standard specifications for asphaltic materials in various kinds of road construction. These specifications are very well drawn up and serve their purpose admirably, provided they are correctly and intelligently used. It is in this regard that experience can help us. In cases where these specifications have been used, nearly all the failures have been due to the fact that the specifications were followed blindly, without an understanding of their value and their interpretation; merely, as it were, substituting in a formula without considering the units involved.

A knowledge of the value and interpretation of each test must be possessed by every engineer who makes or who uses specifications before he can hope to obtain success in the employment of these very desirable materials. This is, in fact, the chief lesson of experience. Then, knowing these facts, and keeping in mind the lessons of service tests of similar materials under similar conditions, the engineer can employ specifications with the assurance that his work will be a success.

The value and interpretation of the more important tests required of asphaltic materials will be discussed.

The individual tests usually specified may be divided into three groups: (1) They may directly indicate the suitability of the material specified for a given use; (2) they may serve as a means of identifying the material or its source, and (3) they may serve to control uniformity in the preparation or manufacture of a material.

¶ SUITABILITY *of the asphalt for the required use is object of first group of tests.*

The most important test belonging to the first group is the determination of the consistency or viscosity. The consistency or viscosity of a material is its degree of firmness as determined by measuring its internal friction. Requiring this test in the specifications is of value, since a physical test can generally be better understood than any corresponding chemical one. This test, however, can be of maximum value only when applied to a specific type of asphaltic material and when considered in connection with other tests, which by themselves may not directly indicate suitability. Thus for one type of bituminous concrete pavement the proper penetration at 25 degrees C. for a California asphalt may be between 7 and 9 mm., while the proper penetration limits for a fluxed Bermudez asphalt to be used in exactly the same type of pavement and under the same conditions, may be from 14 to 16 mm. Again, experience has shown that a harder asphalt cement is needed for a sheet asphalt pavement of sand, powdered limestone and asphalt cement than for a pavement containing crushed stone. The amount of traffic and the climate are also important factors to be considered in fixing penetration limits for any asphaltic material.

Another test serving to indicate the suitability of a material for any special purpose is the volatilization test. A determination is made of the loss in weight of the material by volatilization, and of the consistency of the residue. It is of considerable value when applied to road oils. The loss in weight thus found is a fair indication of the loss by volatilization suffered by the material in the course of time when applied to the road, and also the character of the residue is similar to that eventually left in the road. The residue should be of a sticky nature. If the residues of these oils are not sticky

and adhesive they will produce an undesirable surface in wet weather. A paraffin oil will produce a greasy residue, and is, consequently, worthless for road work, whereas an asphaltic oil may be successfully used for this purpose.

¶ IDENTIFICATION *of source of asphalt is made by the second group of tests.*

The more important tests serving as a means of identifying the source of a material or even the material itself, are the specific gravity, melting point, solubility in carbon disulphid and fixed carbon determinations. The specific gravity of an asphaltic material is one of the most important characteristics used to determine its identity. This is especially true if its specific gravity is considered in connection with the consistency of the material, and sometimes its solubility in carbon disulphide. Thus a bituminous material with a specific gravity of 0.99 and a penetration of 7 mm. at 25 degrees C. is a blown product. Fluid consistency and a high specific gravity of 1.25 in a tar serves to identify it as a coal tar, and the identity is strengthened if its solubility in carbon disulphide is as low as 75 per cent. As applied to oil and oil products, the specific gravity roughly indicates the amount of heavy hydro-carbons which give body to the material. As a rule, paraffin oils have the lowest specific gravity and are of no value for road work, whereas asphaltic oils have the highest specific gravity and are most desirable for this purpose. In regard to solid bitumens as originally found, it must be remembered that the specific gravity will depend largely upon the per cent. of mineral matter. Thus the specific gravity of Trinidad asphalt (containing 37 per cent. of mineral matter) is 1.40, while Gilsonite, an extremely pure native bitumen, has specific gravity of 1.04.

The melting point of a bitumen is directly related to its hardness and brittleness, but the relations for all classes are not the same. The method of employing the material must also be considered in connection with its melting point. If the penetration method is used, the melting point should not be too high, because the highly heated material would be solidified by the cold stone before it had penetrated to any extent. In a bituminous concrete pavement, the melting point may be as high as climatic conditions will allow.

The determination of the solubility in carbon disulphide of an asphaltic material enables the amount and character of the contained bitumen to be ascertained. The percentage of bitumen thus obtained does not alone determine the value of an asphalt for paving purposes. Two asphalts might contain the same amounts of bitumen and yet possess entirely different powers of resistance to the destructive action of the elements. One might possess stability, the other not. The character of the bitumen does, however, indicate, by the amount of mineral matter present, whether an asphalt has been used. Likewise, an absence of mineral matter indicates that the material has been destructively distilled during its preparation.

The amount of fixed carbon in asphaltic material also serves to identify the source of a material. Thus high fixed carbon in most asphaltic cements produced from Mexican petroleums serves to differentiate them from asphalt cements of the same consistency produced from California petroleums. Consequently, if the amount of fixed carbon found in a California asphalt cement were as high as the amount usually present in Mexican asphalts (about 16 per cent.), the indication would be that it has been injured by overheating.

¶ CONTROL OF PREPARATION *and manufacture is secured by the third group of tests.*

The tests that serve to control the preparation and manufacture of a bituminous material are the flash point, distillation, and the solubility in naphtha tests. The temperature at which the material flashes is an indication of the treatment to which it has been subjected. Crude oils have a low flash point, while more highly distilled products have correspondingly higher flash points. The flash point of a material must be considered in connection with its proposed use. If the material, especially a heavy road oil, is to be heated before application, the flash point should be high enough to prevent its ignition while being heated.

The distillation test is a valuable one, especially for tars. No tar containing water should be employed as a permanent binder.

The extent of the solubility in naphtha is an indication of the amount of body-forming hydro-carbons which give mechanical stability to the material. No oil containing les sthan 4 per cent. of bitumen insoluble in naphtha will prove of service other than as a dust preventive.

To the valuable data that may be obtained in the manner described above must be added the lessons of experience and service tests of various asphaltic materials under various conditions and in

different types of roads and pavements.

The need of alleviating the dust nuisance has involved the use of asphaltic oils for that purpose. Experience has shown that the oils used should show some degree of adhesiveness when rubbed between the fingers. Their residues after the evaporation test should be decidedly sticky. If oily, they will act more as lubricants than as dust binders.

It must be emphasized again that paraffin oils are worthless for this purpose. Engineers thruout the country are finding that the use of palliatives for dust prevention is but a makeshift at the most, and that the best practice is tending toward the construction of bituminous surfaces or carpet coats wherever any degree of satisfaction and permanency is desired.

¶ BITUMINOUS SURFACES *protect and improve old wearing surfaces of other materials.*

Bituminous surfaces are used principally on macadam and gravel roads, on bituminous and cement concrete pavements, and to some extent on brick and stone pavements.

The character of the traffic to which the road is to be subjected should be considered in the construction of a surface. Experience has shown that if the road is subjected to light motor and light team traffic only, with the motor vehicles predominating, an asphaltic oil of such viscosity that it requires heating to at least 250 degrees F. before application forms a bituminous surface that withstands the traffic and thoroly preserves the road for a period of time depending upon the quality of the material and workmanship and upon the quantity of traffic.

The failure of many bituminous surfaces can be traced to improper preparation of the broken stone surface.

The adhesion of the oils to the stone is a very essential point to consider. Most engineers are in favor of applying the bituminous material under pressure since the adhesion to the stone is much more satisfactory in this case. In order to get the best adhesion of asphaltic oils, the stone surface should be a little moist rather than extremely dry, but in either case, every particle of dust and dirt should be removed from the stone by sweeping.

With proper construction and under normal traffic conditions, retreatment is necessary every one or two years. In choosing the bituminous material for a surface which will have to be renewed often, experience has shown that care must be taken to select a material which will set up sufficiently to allow the application of repeated layers without producing a plastic, easily moved blanket surface.

Properly constructed, bituminous surfaces are quiet, practically dustless, and comfortable to use.

With the advent of the motor car, it was found that the water-bound macadam pavement did not stand the automobile traffic and that bituminous macadam could be laid to withstand this traffic at a cost equal to water-bound macadam, when the maintenance of the latter is considered. The bituminous material used may be either asphaltic cement or refined coal tar. The former is preferable because it possesses greater stability under atmospheric action.

Here again, numerous instances can be found where unsuitable materials have been employed thru the failure of the engineer to understand the physical and chemical properties of the different types of asphaltic materials, and the different methods of treating them. For example, many a good asphalt has been ruined by overheating. Again, asphalts of too little ductility have been chosen.

The slight displacement of the mineral aggregate of a pavement due to the shocks of hoofs or wheels makes it necessary that the asphalt cementing material should yield and stretch a little and not break. On the other hand, the greater the ductility, the more susceptible is the asphaltic material to changes in temperature. Once more the knowledge of the relationship among the various properties of a material enables the engineer to intelligently set the limits in his specifications.

¶ EXPERIMENTAL SECTIONS OF ROAD *under different amounts of traffic demonstrate the qualities of bituminous surfaces of various kinds.*

A series of experimental sections was constructed on a road subjected to mixed traffic of about 100 horse-drawn vehicles and from 250 to 300 motor cars per day. These sections were constructed with asphalt, refined water gas and coal tars, and combinations of refined coal tars and asphalts, in the form of bituminous concrete pavements, using the same material for the cement and the seal coat. Upon examination after three years, it was found that for this class of traffic, or for horse-drawn traffic exclusively, the seal coat should consist of an asphalt, as being more durable and economical than the other materials.

Experience in another locality has shown that an excess of flux or of the volatile constituents in asphalt cements has been a cause of failure. Pavements constructed with such materials are wavy and distorted by heavy traffic.

One of the most widely used pavements is sheet asphalt. Trinidad asphalt was for many years the only available supply of such material, but in recent times many other sources have been disclosed.

In addition to the native asphalts, like those obtained from Trinidad and Bermudez, asphalts are obtained by refining asphaltic oils. The results of experience and service tests in this kind of pavement alone furnish the engineer with a collection of valuable data. The selection of both the aggregate and the asphalt cement requires a careful understanding of the climate, traffic and other conditions. Proper drainage, in this, as in all other pavements, is a primary requisite. Furthermore, certain bitumens require more skill in handling than others. Again, some require particular fluxing agents and result in failures when improper ones are used.

¶ REQUIREMENTS OF ASPHALT PAVEMENT *include inherent stability, proper fineness of material, proper consistency of asphalt.*

The main requisite of a good sheet asphalt pavement is inherent stability. This can only be obtained if the mineral aggregate is properly selected and if the bitumen possesses cementing value. Experience has shown that the heavier the traffic to which the pavement will be subjected, the finer must be the particles composing the mineral aggregate. In addition, the consistency of the asphalt cement must be of the right degree, that is, the newly laid pavement should not be too hard. The marking up of a pavement by the calks on horses' shoes does not necessarily indicate that the pavement has been improperly constructed. If the pavement were too hard at the start it would have a shorter life than if a softer asphalt cement had been used.

Sheet asphalt pavements properly constructed with native asphalts, either from Trinidad or Bermudez, have given the highest degree of satisfaction. The Barber Asphalt Paving Company recently took a census of the old asphalt pavements. In New York City there are 184,290 square yards of Trinidad sheet asphalt 20 years old or older. A part of this is on Fifth Avenue and is subjected to the very heaviest traffic. The remainder is also subjected to heavy travel, yet all the pavements are in very good condition at the present time. Washington, D. C., has more than 1,000,000 square yards of Trinidad sheet asphalt pavement laid between 1877 and 1901. The average cost of maintenance is 1.8c per square yard per year.

Recut Granite Block Pavements

Condensed from a Paper by William A. Howell, Engineer of Streets and Highways of Newark, N. J., before the American Society of Municipal Improvements.

Until recent years old granite block pavements were not supposed to have any great commercial value, there being no regular demand for this form of paving material. In May, 1911, our city (Newark, N. J.) received bids for paving a very important thorofare, Market street, with smooth pavement, and provided that the old granite blocks should be removed and become the property of the contractor and that he should make allowance for these blocks in his bid for the new smooth pavement of another kind. The amount of granite blocks was about 23,500 square yards. The bidder was not particularly pleased, because he expected to have the old blocks on his hands for about ten years. A market for them after recutting began in 1913 in Kearney, mentioned below. During 1914 Newark replaced 75,500 square yards of old granite block pavement on Broad street with wood block pavement. The number of old blocks aggregated 1,085,000, of which about 85 per cent. could be recut and used on other streets. Newark is selling these blocks to contractors to be recut, napped and used for new pavements, at $30 per thousand blocks. These blocks represent an asset to the city of about $31,000. A very tidy sum for the street repair fund. Further detailed mention of use of recut blocks in Newark is found below.

The writer asked an important granite block manufacturer of Maine in 1909: "To what use can old granite blocks be put?" He answered: "They could be cut in two (called napped), reclipped and would practically make a new pavement."

¶ RECUT GRANITE BLOCKS *were first laid in Bronx Boro, New York City, in* 1909.

The first street known to the writer where recut granite blocks were used is Webster avenue, Bronx Boro, New York City, in 1909. The old blocks were 7 to 8 inches deep and in fair condition, having originally come from Long Cove, Me.; Cape Ann, Mass., etc. The specifications for the recut blocks required them to be 6 to 12 inches long, 3½ to 4½ inches wide, 5½ to 6½ inches deep. Where some blocks ran up to 5 inches wide they were allowed to be used, provided the entire course had the same width. The price for Webster avenue was $1.27 per square yard

for paving and 55 cents per square yard for concrete foundation 5 inches thick, total $1.82 per square yard. The joints were filled with portland cement grout. This pavement is in first-class condition today. Since then, Bronx Boro has laid thousands of yards of this form of pavement. The old blocks were simply cut thru into smaller sizes, squared up to give a joint not exceeding ¾ of an inch. The price paid for recutting in 1909 was $10 per thousand blocks.

In Philadelphia, William H. Connell, chief engineer of highways, informed the writer they have one street laid with reclipped and grouted old granite blocks, 10,546 square yards of Broad street, between Cumberland street and Silver street. The old granite blocks were taken up, reclipped and relaid on the street in June, 1913, at a cost of $1.43 per square yard, including sand cushion. The old concrete foundation remained and was used. The specifications required blocks to be redressed to 5 to 6 inches deep, 5 to 7 inches long, 3½ to 5 inches wide.

Mr. Connell states: "The laying of this kind of pavement is very economical and it equals in smoothness and appearance the latest and best type of construction of granite block paving." The writer inspected this street in July, 1914, and was pleased with its appearance. The heads of the blocks are remarkably smooth and the joints appear closer than could be obtained on the majority of streets laid with new granite blocks.

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¶ RECUT GRANITE BLOCKS *were used in Troy, N. Y., at a material reduction in cost.*

Troy, N. Y., City Engineer A. E. Roche, writes: "During the past year Troy has gone into the splitting and quartering of its old granite block pavements and relaying them on quite an extensive basis. The blocks had been in use 30 or 40 years and were Rockport granite 9 to 14 inches long, 5 to 6 wide, 7 to 8 deep, rounded on the surface and very uneven. The blocks were halved and quartered (napped and reclipped, as it is called in Newark). The contractor took up the old blocks, removed them to any plot of ground he could hire, made them into new blocks 7 to 9 inches long, 4 to 5 inches wide, 4 to 5 inches deep. He then graded the street, laid the concrete foundation, spread a sand cushion, laid the blocks and filled the joints with portland cement grout. Attention was given to the necessity of alwas having the new face of blocks uppermost. The price was $2.30 per square yard, including excavation, concrete foundation and five years' maintenance and guarantee.

"Troy required the contractor to recut all the old granite blocks, altho an excess of about 25 per cent. of first-class blocks would be obtained over and above those required. The city allowed the contractor $15 per thousand for those delivered at such points within one-half mile, as the city engineer directed. Troy expended in 1914 for recut block pavements $62,000. That city previously paid an average price of $3.85 per square yard for close jointed Concord (N. H.) new granite block pavements. Troy expects next year to lay 22,000 square yards of recut old granite blocks by halving and quartering them, rather than discard the old for the new ones."

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¶ BROOKLYN AND MANHATTAN *boros of New York have used recut granite blocks with success and economy.*

Brooklyn, N. Y., Chief Engineer of Highways H. H. Schmidt states: "We have not used what is commonly known as napped blocks, but have paved a number of streets with recut granite blocks made from the old large stones by redressing them to the regular specification size. He gives a list of six streets, comprising 29,965 square yards, which cost, including recutting, supplying a 6-inch concrete foundation, etc., an average of $3.65 per square yard.

Manhattan Boro, New York, Chief Engineer W. H. Durham states that until recently no reclipped granite blocks were used in Manhattan, but that a contract has just been completed on Avenue A from 54th to 57th street, about 5,500 sq. yds., using the old blocks on the street. They are broken in two and laid with the fractured side as the new head and upon 1 inch of sand cushion; of this 1,830 square yards were filled with tar filler and 3,670 square yards with cement grout for purposes of comparison. The cost for wearing surface was $1.45 per square yard and 55 cents for concrete foundation; total $2. The old blocks in this case furnished material for only 60 per cent of the area, the remainder having to be supplied with new material by the contractor.

Trenton, N. J., has recently laid 3,500 square yards of this form of pavement, using cement grout for filler. The old blocks were furnished by the city and the price on 5-inch concrete foundation was $1.58 per square yard.

The credit of introducing this form of pavement belongs to Bronx Boro, New York City, where Mr. R. H. Gillespie, chief engineer of sewers and highways,

has furnished the writer valuable information and a long list of streets thus paved, at an average cost for 213,341 square yards of $1.72 per square yard, including 5-inch concrete foundation. This was for pavements laid from 1909 to 1914. The average cost up to November, 1913, for all streets thus paved, 267,150 square yards, or about 8 miles, was about $1.68 per square yard for recut old granite block on a 5-inch concrete foundation, compared with an average of about $3.67 per square yard for new granite block on same foundation. A considerable portion of the old blocks ran from 12 to 14 inches in length and 7 inches depth. The blocks were split, broken in two and dressed so as to lay ½-inch joints. The finished blocks are from 6½ to 8 inches long, 3½ to 4¼ inches wide, 5½ to 6½ inches deep. Blocks less than 11 inches long are reheaded when necessary and dressed and as a rule used along railway tracks. The splitting and dressing is done on the street by stone cutters, who receive about 1½ cents per redressed block, or $15 per thousand; each man getting out from 450 to 600 blocks per 8-hour day. He earns about $7.75 per day, depending partly on his skill and speed and partly on the character of the granite and condition of the old blocks. The blocks when dressed are piled along the sidewalk until the concrete foundation is ready for the pavement. They are laid in the usual manner in rows at right angles to the curb line and on a 6-inch, 1-3-6 concrete foundation and 1½-inch sand cushion. The pavement alone, exclusive of concrete foundation, costs an average of $1.21 per square yard as compared with an average cost of $3.20 of new improved granite block, exclusive of foundation.

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¶ RESULTS IN ALBANY, N. Y., *with recut granite blocks have been equally satisfactory.*

Albany, N. Y., City Engineer F. R. Lanagan, states that Albany is taking up old granite blocks in 1913 and 1914 on many streets, breaking them in half, redressing when necessary, relaying with the new surface upon a 6-inch, 1-3-6 concrete foundation and grouting the joints with 1 to 1 portland cement grout. Old blocks there vary in size and form so that from many old blocks but one new block can be obtained, but generally there is a surplus from a given area. The price per square yard includes taking up old blocks, breaking and redressing into new blocks, 6-inch concrete foundation, sand cushion 1½ inches, laying, ramming, grouting and five years' maintenance. The average price of a list of six streets given, for 32,800 square yards, was $2.35 per square yard. The size of the recut blocks is not less than 6 inches in length, 3½ to 4½ inches wide, 5 to 6 inches deep. Soft, brittle or laminated stone is rejected. The city supplies the number of old granite blocks needed to be recut and used as stated by the contractor, who, however, does the carting.

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¶ NEW JERSEY CITIES *have followed the practice of using recut granite blocks with satisfaction.*

Kearney, N. J., during 1913, paved Tappan street, between Davis street and Chestnut street, with napped and redressed old granite paving blocks, which had been removed from Market street, Newark, N. J., nearby. The area was 3,278 square yards at a contract price, including 6-inch concrete foundation, of $2.48 per square yard.

Newark, N. J., made its first attempt to pave with napped and reclipped old granite blocks on Meeker avenue, from Frelinghuysen avenue to Western avenue. The contractor did not pay enough to get good results, and his old blocks came from different streets representing original output of different quarries. After much patience, the pavement was finally accepted. During 1914 contracts were made for this kind of paving for six streets, covering 26,900 square yards, at a cost of $94,337, or $3.50 per square yard, which includes concrete foundation, sand cushion, cost of purchase, recutting, laying the blocks and grouting the joints. The city, however, had received from the contractor the price he paid the city for the old granite blocks at $30 a thousand, representing about 60 cents per square yard. A portion of these pavements have been completed and give general satisfaction. The contractors have at their command the granite blocks from the old Broad street pavement, which, during 1914, was being replaced with wood block pavement. The smooth heads of these recut granite blocks and the close joints are very noticeable, even to an ordinary observer. From Washington street to High street, between William street and Clinton avenue, are a number of streets which until recently were paved with cobblestones. Of these streets referred to, Spruce street, Crawford street and East Kinney street have been paved with new grouted granite bolcks, while Baldwin street, Longworth street and Court street have been paved with napped or recut and reclipped old granite blocks; which three pavements compared very favorably with the first three and cost

about 60 cents per square yard less. Newark has under consideration the repaving of three very important streets with recut granite blocks, the intention being to use as much of the old granite paving material now on those streets as conditions will warrant. The streets referred to are Ferry street, from Market street to Lantz avenue, 21,000 square yards; Washington street, from Market street to Central avenue, 6,400 square yards; Plane street, from Market street to State street, 14,800 square yards; the estimated cost being $128,600, an average of $3.49 per square yard for everything, including concrete foundation. Because a bond issue is contemplated, it is doubtful if at this time these pavements will be laid.

The old granite blocks in Newark, used during 1914 for recutting and paving, range from 10 to 14 inches long.

¶ ESTIMATES OF COST *show the reasons for the less cost of the recut granite block pavements.*

A block maker in a day's work of eight hours can nap or cut thru and reclip or redress 175 of the large old blocks into 350 new small blocks. It costs the contractor to do this, $12.50 per thousand for small blocks produced, i. e. $25 per thousand of the large old blocks used. The large old blocks run twenty-one and recut into small new blocks forty-two per square yard. A rough detailed estimate of the cost in Newark of this kind of pavement, with a variation of possibly 10 to 15 cents, would be about as follows per square yard:

Twenty-one old blocks per square yard paid city at 3c each	$ .63
Paid stone cutters (per thousand finished $25)	.53
Hauling	.10
Handling and laying	.20
Grouting	.12
Sand cushion	.05
Concrete foundation, 6-inch	.65
Grading	.10
Total	$2.38

A list of eleven streets is given, for which contracts were awarded during 1913 and 1914, at an average payment to the contractor, including everything, of $3.36 per square yard.

The only difference in the specifications in Newark for new and recut granite block pavements is the dimensions of the recut blocks, which shall be not less than 6 nor more than 12 inches long, instead of not less than 8 nor more than 12 inches for new blocks from quarries.

As to the financial saving effected by the use of recut and napped or redressed blocks in Newark, with prevailing prices, the assessment on the property owner on a 36-foot wide street, using new granite and new curb, would be about $8 per foot front, or $200 for a 25-foot lot. If napped and reclipped, that is recut old granite blocks are used (the old blocks being sold at $30 per 1,000 to the contractor by the city), the probable cost per foot of assessment to the property owner would be $6.35 per front foot, or $158.75 per 25-foot lot, with old blocks obtained from other streets. But if the old paving blocks on the street are taken up, napped and redressed and used in replacing that pavement, a still greater saving can be effected; so that the estimated cost per foot front would be $4.75, or $125 per 25-foot lot.

¶ DURABILITY *has always been an essential in pavements with heavy traffic, and now granite block pavements can be reduced in cost and roughness without loss of durability.*

Twenty-five or thirty years ago, when paving of important thorofares was under consideration, the main point influencing municipal authorities, aside from the cost, was the question of durability. This explains the presence of granite pavements on many streets of cities where other paving materials would have been selected if they had been known to possess equal durability. Few pavements were laid on a concrete foundation previous to 1890, and the entirely unnecessary thickness or depth of 7, 8 and 9 inches of granite blocks was to a certain degree excusable. After the general adoption of concrete base under granite pavements, it required nearly twenty years' constant agitation to reduce the thickness of the blocks to the reasonable standards of the present day. Some cities have reduced the thickness to 4 inches.

The main object of this paper is to awaken interest in this form of pavement, which affords a chance to lay a durable and practically new pavement at a very low cost. Any town or village having any old-time granite pavements, laid either on sand or concrete foundation, is in a position to get a new pavement at minimum cost. A granite pavement which has given twenty-five years' service may give an additional service of twenty-five years under the methods described in this paper, which would put granite as a paving material in the first place as far as durability is concerned.

Municipal Notes

Apparatus for Detecting Smoking Chimneys on Trial

It has long been recognized that careful manipulation of the fires under the boiler will reduce the smoke problem at least 50 per cent. The trouble has usually been due to the top of the stack being out of sight of the fireman. Professor W. W. Strong, during his investigation of the smoke problem for the Pittsburgh University, recognizing this fact, has designed an electrical apparatus that will not only indicate when the stack is smoking, but also record the number of minutes that it smokes. One of these devices has been placed by the Smoke Abatement Commission of Baltimore, Md., at the power plant connected with the Mt. Claire shops of the Baltimore & Ohio railroad.

The apparatus is essentially an electrical device and its action depends upon the state of ionisation of the flue gases.

Accompanied by proper direction as to how firing should be done, this apparatus should help materially in the work of smoke abatement.

Municipal Improvements in Peru

The following discussion of the public health situation in Peru is condensed from a recent issue of *Peru Today*:

Peru has paid serious attention during the past decade to the water supply and drainage of her principal towns, and is continually authorizing new studies and installations. The work is carried on under the immediate direction of the Section of Public Health of the Ministry of Public Works and Development. The sanitary laws in force are based on English practice, with certain modifications to adapt them to the customs of the people.

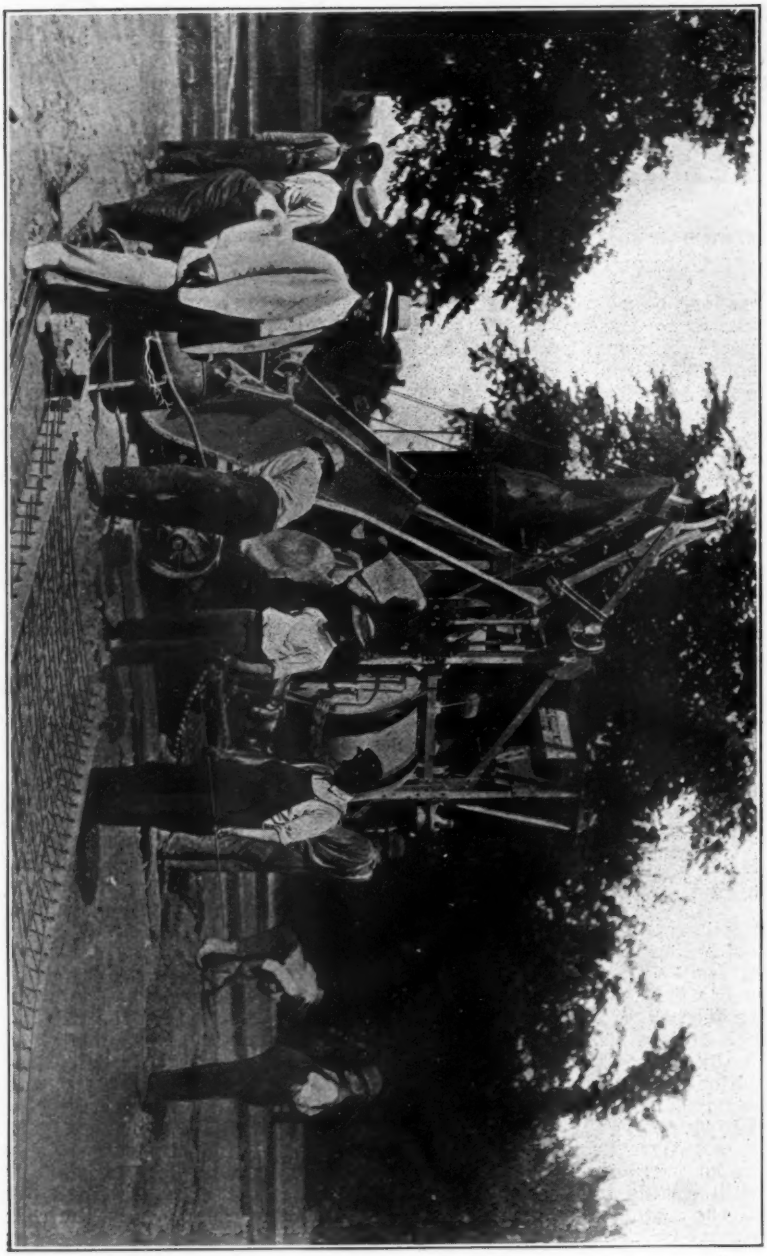
The government has taken in hand the matter of providing an improved water supply for the Lima district, including Lima and the neighboring seaside resorts of Chorrillos, Barranco, Miraflores, Magdalena, and possibly Callao. In the last-named city water and drainage works are now nearing completion. The sewerage system of Callao divides the town into three zones, with the sea outfalls located where the current carries all sewage away promptly. Two of the zones utilize the ejector system of automatic compressed-air lift, while the third is entirely a gravity system. The water works for Callao, which has a population at present of 34,436, will provide a daily supply of nearly 4,000,000 gallons.

At Arequipa, the second city of Peru, the water works capacity is to be increased to 2,377,000 gallons per day, at a cost of $263,000, and the drainage system is to be extended. Water is now brought into the town of Trujillo, but is not distributed to the houses. The plans provide for a supply of about 660,400 gallons per day, with a filtration plant and a system of distributing mains. Similar improvements are planned for many of the smaller towns and summer resorts.

Reinforced Concrete Pavement Foundation Over Trench

The accompanying photograph shows a method of replacing pavement foundations over trenches cut thru for sewers or other public utility pipes, lines or conduits in use in St. Paul, Minn., where Oscar Claussen is chief engineer.

It will be seen that rods less than 1 inch in diameter are used, set about 6 inches apart across the trench and 8 to 12 inches apart longitudinally. The transverse rods are held in place while the concrete is being laid by means of the boards shown, which have holes bored in them about 1 inch in diameter, which hold the rods in place. As soon as the concrete is in place sufficiently to hold the rods the boards are lifted out, the slots allowing them to pass the rods, and they are then ready to use in the next length of trench. The reinforcing rods cost about $2.30 per 100 pounds, delivered on the street. Handling and setting place cost less than 1 cent a pound. J. E. Carroll, assistant city engineer, has furnished the data and the cut.



LAYING REINFORCED CONCRETE *over trench cut in street pavement. Note method of keeping reinforcement in place while laying concrete.*

Pasadena's Municipal Electric Plant Has Saved Consumers $731,083

The operation of the municipal lighting plant in Pasadena has broken all records for economy, according to the annual report. Among other things, it says: "The saving resulting to the people of Pasadena from October 1, 1908, to June 30, 1913, by reason of the difference in rates charged before the city entered the light and power business and the rates charged our neighboring cities since, amounts to $557,583.90, plus the saving for the past year of $174,000, making a total saving of $731,083.96. The rate was 15c per k.w. hour when the city began talking about a municipal plant. Then it dropped to 12½ cents, while the plant was being built. When the rate was lowered to meet the 8-cent rate established by the city, the 12½-cent rate was continued in force in other southern California cities by our pompetitor. Subsequently the base rate in some of the other cities was reduced to 10 cents, and so remained until January, 1913, when a rate of 8 cents was established. On April 1, 1914, a base rate of 7 cents was made by the city's competitor in various other cities. However, this is considerably higher when compared with the rate of 5 cents charged by Pasadena's municipal plant."

Dismissal of Employes Under Civil Service

The problem of determining when a man should be dismissed from a service based on merit without suspicion of bias or prejudice is a different one. Under some systems of civil service rules the commissioner in charge of the department is the sole judge of the propriety of discharging a man. In others the man can appeal to the Civil Service Board.

In the Boro of Manhattan, New York, President Marks has established a joint board made up of two fellow employes chosen by lot and two officials, commissioner or superintendent to advise him as to the disposition of a case.

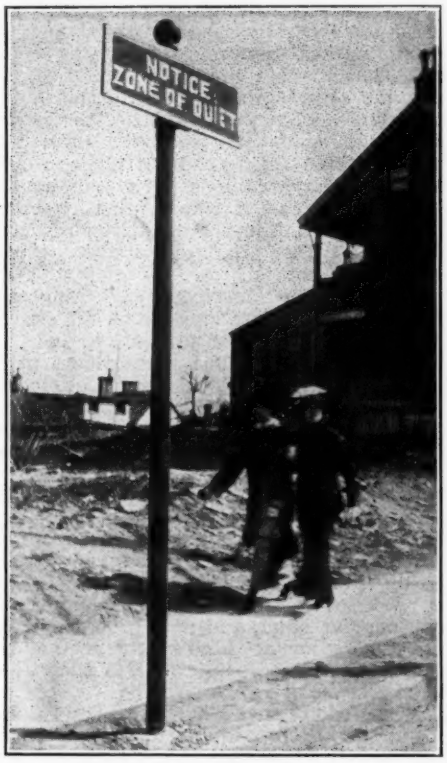
In the first cases under the new plan the charges were preferred, before a board constituted as above, by the head of the bureau in which the man complained of was employed. After various questions had been asked and answered of the man and the bureau head, all retired but the board and the man's dismissal was recommended. The second case, in which the charge was repeated intoxication during working hours with a plea of guilty and request for leniency, removal was recommended.

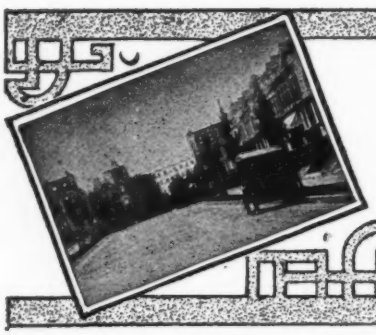
President Marks states that his previous experience has been similar in that recommendations by fellow employes as to dismissal or retention are based on the utmost sense of fairness and justice.

Zone of Quiet Signs

Motorists have noted how even some of the smallest villages having hospitals, sanitariums and the like, are mounting "zone of quiet" signs at the roadsides, as an unspoken request to the automobilist that he not only moderate his speed with the attendant roar, but also refrain from useless soundings of klaxon or other horn. So effective have these signs become and so welcome the relief brought by them that communities are eager to erect the sign-posts on their highways; and auto supply dealers and the like find that a morning can be made quite profitable by speeding forth to communities not already provided and soliciting orders for such sentinels of the road.

The photograph shows a sign of the sort, of rather artistic arrangement, as set up near the various hospitals and infirmaries by the city government of Cincinnati. The lettering is in two colors put behind a pane of glass, with an iridescent background.





MISCELLANEOUS

Road Congress of the American Highway Association

The Atlanta Road Congress held the week of November 9 registered over 3,300 attendants, including local attendance of the first day only. Over 100 exhibitors crowded the auditorium, two city blocks in a temporary structure, and two blocks under a convenient viaduct. Many excellent papers were presented, abstracts from some of which appear in this number of MUNICIPAL ENGINEERING and will appear in later numbers.

Among the resolutions adopted by the congress were the following:

Resolved, That the American Road Congress emphatically endorses the principle of federal co-operation toward the construction of main highways and thus assist the several states to build the main market roads on the one-half of the country which is devoted to agriculture and to build thru main roads in the one-half of the country which is not predominantly agricultural, but whose prosperity depends upon mining, the raising of live stock and the presence of the health seeker and tourist.

Whereas, the American Road Congress believes in and has long urged all states to enact uniform road legislation, and,

Whereas, experience has abundantly demonstrated that efficiency and economy are not obtained in the construction and upkeep of main roads, except by the co-operation of the states thru skilled departments, and,

Whereas, forty of the forty-eight states have enacted state legislation, Georgia, Indiana, North Carolina, South Carolina, Tennessee, Arkansas, Florida and Texas being the exceptions, and,

Whereas, Federal aid and co-operation are near at hand, and it is probable that states having no highway departments will be unable to participate in such aid, therefore be it

Resolved, That the American Road Con-Congress in annual convention assembled in the city of Atlanta, embracing several thousand delegates, representing every state, reaffirm its belief that state road departments and state aid are essential to secure efficiency and economy;

Resolved, That the Lincoln Highway Association be commended for its successful voluntary effort in arranging with counties, cities and townships for a connected series of roads across the United States, thus providing a definite and continuous route to be used wholly or in part by those who wish to become acquainted with the agricultural, mining and scenic advantages of their own land;

Resolved, That the American Road Congress deplores the frequent accidents on the public highways and urges upon the various highway officials or other authorities thruout the United States the enactment of the necessary rules and regulations to insure the public safety;

Resolved, That the federal government be urged to build highways across all Indian and forest reservations and all other federalized areas, where such connecting links are essential parts of established thru routes of travel.

Government Exhibit at American Road Congress

The Office of Public Roads of the United States Department of Agriculture displayed at Atlanta, Ga., during the fourth American Road Congress, November 9-13, a complete set of models illustrating the construction and maintenance of standard types of roads. The models were so arranged as to present the historical and technical development of road building. Thus a set of models showed the evolution of stone road building for a period of 2,000 years, including the Appian Way, as representing the Roman type of construction; the early French roads during the reign of Napoleon I, the Telford and early macadam roads built in England during the reign of George IV, and macadam roads as they are constructed today.

One of the models illustrated the characteristic features of road construction in

the Swiss Alps; another the best practice in this country of road location and relocation. In the latter model is shown an old earth road, with characteristic features, such as steep grades, bad alinement, dangerous grade crossing, unsafe wooden bridge, poor location, inadequate drainage, dilapidated farm buildings and the old district school house, with unsightly and unsanitary surroundings. In the same model was shown the new road, located on high ground on side hill slopes, with easy grades, pleasing and practical alinement, with grade crossing eliminated, permanent culvert and bridge, good drainage, a well constructed and maintained macadam surface, sightly farm buildings and attractive consolidated district school house, supplied with pure water by means of windmill and reservoir.

The most approved methods of subdrainage for roads which pass over soft or unstable ground were shown by a model which represented the V-drain, the Telford base and the French drain. Models showing details of construction and important stages in the building of a reinforced concrete culvert and a concrete bridge of the incased steel I-beam type were also included.

Three of the models illustrated the construction of earth, sand-clay and gravel roads. Miniature mechanical models in actual operation showed the quarrying and crushing of stone and the use of a power roller working on a macadam road.

Since the coming of the automobile, with the consequent aggravation of the dust nuisance, numerous methods have been devised to secure lasting and dustless road surfaces. The most important of the types thus developed, aside from the paved roads adapted to heavy traffic, such as asphalt block, brick and concrete, of which appropriate models were included, are generally classed as bituminous construction. These types have been largely developed during the past few years, and were represented in the exhibit by the following models: Surface treatment of new macadam road, resurface of old macadam road by the penetration method, penetration method, mixing method, mixed filler method, rock asphalt and Topeka specification.

All the models were built to the scale of 1 inch to the foot, or one-twelfth of the full size.

An automatic projectoscope presented a large number of self-reading lantern slides, showing road scenes in many parts of the United States.

Several sets of motion picture films, representing construction scenes on the post roads now being built by the Office of Public Roads in co-operation with the Postoffice Department, and the various States, were shown.

American Cement Confiscated in Egypt

A carload of white portland cement, shipped by the Sandusky Portland Cement Co. to a German citizen resident in Jerusalem, before the European war began, seems to have been confiscated by the British authorities in Egypt as contraband of war. The cement company has protested to the Department of State that this is an attack on private property which is not authorized.

Four smaller shipments to India have not been delivered, at least one being on a steamer now in a Spanish port, where it cannot be unloaded and is likely to stay until after the war is over.

Literature on Petroleum

The United States Bureau of Mines has begun the collection of a general library of petroleum literature, under the direction of W. A. Williams, chief petroleum technologist. The details of this work have been assigned to Dr. David T. Day, who has recently been transferred from the United States Geological Survey as petroleum technologist, and who will assist in a thoroly organized research into the chemistry of oils, which is being developed by the Bureau of Mines. The importance of such a library is so manifest that it is hoped all technologists will aid in the work by exchanging with the bureau all available books and maps on this subject.

The San Diego Exposition

San Diego was the first city to charter an exposition in celebration of the opening of the Panama Canal, in which, naturally, it is vitally interested, owing to its location as the first port of call north of the isthmus. When San Francisco, six hundred miles to the north, chartered another exposition, San Diego put away its program of holding a world's fair of the old type, such as Chicago and St. Louis had held, and began reaching out for new ideas. The architecture itself is new, insofar as exposition work is concerned, altho in reality it is a renaissance of the old Spanish art and architecture which was flourishing in the southwest two and three centuries ago. Some of the finest relics in southern California are the old Spanish missions, and they, with the palaces and cathedrals of old Mexico, serve as models for the renaissance. The design is peculiarly appropriate in a country whose most romantic traditions are those of the Spanish occupation and

THE PRADO *in the Panama-California Exposition Grounds at San Diego, California.*

settlement, and whose natural landscape is such as to be set off best by the Spanish type of building.

A most imposing view it is to look down to the strand of Coronado, Fort Rosencrans, and the great sea, less than a mile away from the Exposition Beautiful; and back up the valleys over orchards or orange and olive, over broad vineyards, to the snow-capped Sierras of California and the low hills of Mexico, scarcely twenty miles away.

In the immediate foreground the buildings are covered with the rich floral growth of southern California, with clambering rose and geranium, with honeysuckle and the blazing bougainvillea. The streets are lined with trees and shrubs, with guards and attendants in the costumes of old Spain. The harmony of sea and sky and mountain and valley, the quaint buildings and the abundant foliage, are an impressive restoration of the days of romance.

The accompanying photograph shows the Prado, as seen from the Ethnology building, and illustrates the description given. We are indebted for it to the Seagrave Company, of Columbus, O., who supply the fire protection apparatus for the buildings. The photograph is copyrighted by the Panama-California Exposition.

Prizes for Essays on Highway Construction

Students of the leading engineering schools have been offered an opportunity to compete for $1,000 in prizes on essays on highway construction. The subjects suggested cover a wide range, including factors which should govern the choice of types of pavements and roads and the materials used therein, an ideal paving program for a city of 25,000, economics of highway construction, and half a dozen related topics. The prizes are offered by the Barber Asphalt Paving Company to promote investigation of highway problems by engineering students and to encourage them to enter a field of work where there is great need for trained men.

Technical Associations

The next meeting of the National Fire Protection Association will be held in New York May 11-13, 1915. The year book of the association contains a list of officers and committees and of over 3,000 members, active and associate.

The International Engineering Congress to be held in connection with the Panama-Pacific Exposition, will meet September 20-25, 1915, in the new municipal auditorium building in the civic center of San Francisco. Some 220 papers are already provided for and it is expected that 300 or more papers and formal discussions by eminent engineers from all parts of the world will appear in the transactions. These will be published for subscribers. Membership in the congress costs $5 and entitles the holder to the volume of proceedings and to any one of the ten volumes of transactions desired. All the volumes can be obtained on reasonable terms. Subscriptions to membership should be sent promptly to the committee of management, W. A. Cattell, secretary and treasurer, Foxcroft building, San Francisco, Cal.

A convention of Alabama city officials has been called by the College of Engineering of the University of Alabama, for the purpose of organizing a state league of municipalities. The convention will be held in Tuscaloosa on December 3 and 4. The proposition is meeting with an enthusiastic response.

On November 11 the New York Electrical Society heard a paper by W. M. Johnson on "Electric Furnace Loads for Hydro-Electric Plants," which discussed the relative economic value of electricity and coke or coal for smelting ores and refining metals, tho an electrically generated calorie costs more than a carbon-generated calorie.

The New York Peace Society has provided a series of lectures for December 10, January 28, February 25 and March 25, the first by John Barrett Moore on "Past and Present Relations of the United States to the American Republics"; the second by Senator Theodore E. Burton on "Industrial and Commercial Effects of the Panama Canal and Their Influence on World Relations"; the third by Secretary William J. Bryan on "Possibilities of Friendly Co-operation Between the United States and Latin America," and the fourth by Prof. Franklin H. Giddings on "The Western Hemisphere and the World of Tomorrow," to be delivered in Aeolian Hall, New York City.

The National Civic Federation meets in New York City December 3-5.

The General Contractors' Association holds its convention December 3 in New York.

The American Civic Alliance will hold a convention in New York City December 28.

The American Portland Cement Manufacturers' Association meeting for December is to be held in New York City.

The Illinois Water Supply Association, at a meeting held in Chicago November 11, voted almost unanimously to affiliate with the American Water Works Association as a section of that organization. H. M. Ely was selected as chairman of the section then organized, and Edward Bartow, Urbana, Ill., was selected by the executive committee as secretary. Papers were read by Langdon Pearse on "The Evanston Filtration Plant," and by Edward Bartow on "European Water Purification and Sewage Disposal Plants" as observed last summer.

The Minnesota Surveyors and Engineers' Society will meet at St. Paul in February, 1915.

The program for the road congress of the American Road Builders' Association, to be held at the International Amphitheater, Chicago, Ill., December 14-18, promises one of the most interesting and instructive sessions yet held. The exhibit of road materials and machinery is also most promising.

Technical Schools

The announcement of the graduate course in highway engineering at Columbia University for 1914-5 has been issued. The complete graduate course leading to degree of Master of Arts requires an attendance of two winter periods of four months each, or the equivalent thereof. As practically all the graduate courses are given in periods of from two to four weeks, it is, however, practicable for highway officials, engineers, chemists, contractors and others interested in highway engineering to take various groups of courses. During 1913-4 the following fields of activity were represented by the graduate students in highway engineering: State and county highway departments, 10; municipal highway departments, 17; university faculties, 3; contractors' organizations, 10; sales, engineering and research departments of companies manufacturing road and paving machinery or materials, 13.

The number of students in the undergraduate College of Engineering of the University of Illinois on November 1 was 1,202, ranging from 277 in the department of electrical engineering to 30 in that of railway engineering.

The Indiana University Bulletin for October, 1914, contains No. 22 of Indiana University Studies, on "The Flood of 1913 in the Lower White River Region of Indi-

ana," by Hal P. Bybee, A. M., and Clyde A. Malott, A. B.

The University of Illinois Bulletin for May 18, 1914, just received, is Water Survey Series No. 11, which contains the report for 1913 of the Chemical and Biological Survey of the Waters of Illinois.

Civil Service Examinations

Examinations will be held at the usual places by the United States Civil Service Commission as follows:

December 15: Hydro-electrical engineer in Quartermaster Corps, U. S. Army, at Camp John Hay, Philippine Islands, at $2,400 a year, transportation and expenses to the camp.

Personal Notes

Dr. J. A. L. Waddell and Mr. John Lyle Harrington announce the dissolution of the firm of Waddell & Harrington. The firm's business will be conducted as usual till the conclusion of its affairs in July, 1915, except that it is accepting no new commissions. Dr. Waddell will give his attention to special engineering and financial matters and to important advisory work. Mr. Harrington will be joined by the firm's associate engineers, Mr. E. E. Howard and Mr. Louis R. Ash, in the establishment of the firm of Harrington, Howard & Ash, consulting engineers, who will conduct a general consulting practice, similar to their past work, including hydro-electric development, advisory municipal engineering, appraisals, examinations and reports upon engineering projects, giving special attention to foundations, bridges, particularly movable spans, and other structures in steel and reinforced concrete, with offices at 1012 Baltimore avenue, Kansas City, Mo.

Mr. Harrington spent many years in bridge and structural shops, two of which he designed and operated, in the service of railroad companies, and in mechanical and electrical work. For three years he was the executive engineer of the C. W. Hunt Company of New York, and for two years he was chief engineer and manager of the Locomotive and Machine Company, of Montreal, the American Locomotive Company's Canadian subsidiary. For the past eight years he has been a member of the recently dissolved firm of Waddell & Harrington, consulting engineers, Kansas City, Mo., and in that capacity has developed the vertical lift bridge and directed the design and construction of many million dollars' worth of important bridge work.

Mr. Howard has been associated with Dr. J. A. L. Waddell for fourteen years, for many years principal assistant engineer and later associate engineer of the firm of Waddell & Harrington. His experience covers every phase of the firm's work, at various times directing the office work, having general supervision of field operations, and serving generally in executive capacity.

Mr. Ash has had many years' experience in engineering work, and from July, 1910, to April, 1913, was city engineer of Kansas City, Mo., in which capacity he was responsible for the design and construction of large undertakings, covering several million dollars' worth of sewers, paving, grading, flood protection work, etc. He also made an appraisal of the property of the Metropolitan Street Railway Company and was engineering adviser for the city in the street railway franchise negotiations. Mr. Ash resigned the office of city engineer to become associate engineer and office manager of Waddell & Harrington.

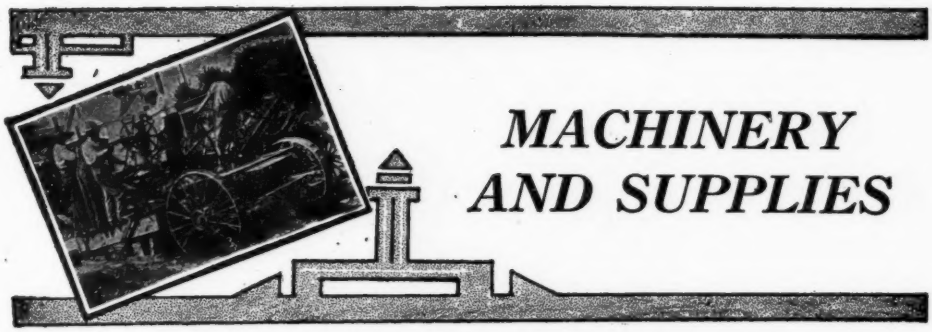
Secretary Lane of the Department of the Interior has appointed Garrett B. James, of the engineering staff of Underwriters' Laboratories, as consulting engineer in the Bureau of Mines, to carry forward an investigation of the subject of oil fires. Mr. James has been granted a three months' leave of absence by the laboratories and is at present in the Texas oil fields.

Publications Received

Municipal Charters, a discussion of the essentials of a city charter with forms or models for adoption. By Nathan Matthews, LL. D., mayor of Boston, 1891-5; chairman Boston Finance Commission, 1907-9; lecturer on Municipal Government in Harvard University. Cloth, 210 pp., $2 net. Harvard University Press, Cambridge, Mass.

Report on pollution of Des Plaines river and remedies therefor, made to the Board of Trustees of the Sanitary District of Chicago by George M. Wisner, chief engineer, and Langdon Pearse, division engineer.

Bell's School and Mine is one of a collection of essays on education, by William Suddards Franklin, published by Franklin, MacNutt & Charles. South Bethlehem, Pa., at 50 cents, in cloth.



MACHINERY AND SUPPLIES

The Development of the Road Paving Plant

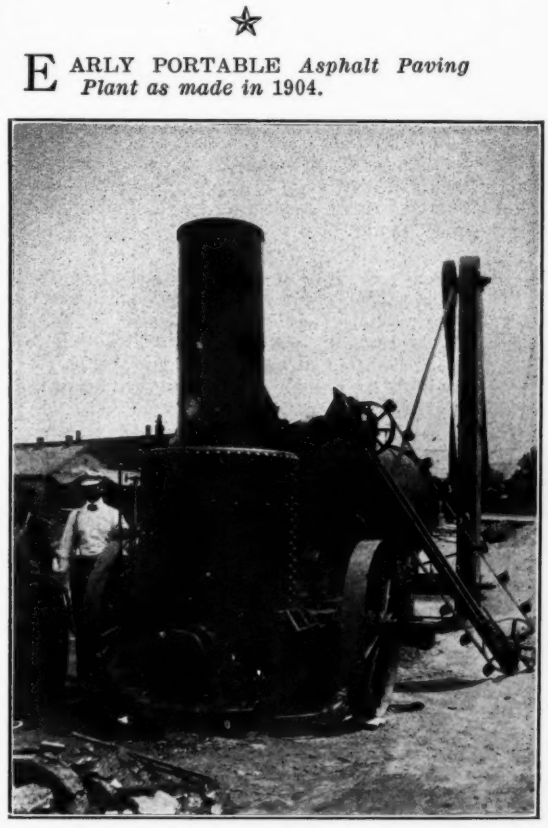
In the road making and paving industries there has been for several years an increasing need for a portable paving plant that could be operated successfully and profitably at points too far removed from a railroad to permit of the use of a portable railway plant; a plant which would also be sufficient, in matters of capacity and efficiency, to permit of the introduction of the asphalt or bituminous roadway or street into the smaller cities and towns which could not hold out to the regular paving contractor sufficient prospects of profitable business to justify him in going after such work with his large and expensive portable railway plant.

At first sight, to the layman, it would seem a simple proposition to produce such a plant, but many knotty problems present themselves to the inventor and mechanical engineer when this matter is studied. In the first place it is imperative that such an outfit be built within certain limits of bulk and weight, in order that it may be readily transported upon the ordinary platform freight car. It must not be too heavy to be hauled from place to place by a traction engine, or even horses if need be. It must also be designed and constructed so that it will withstand the racking caused by rough and uneven roads over which it may have to travel.

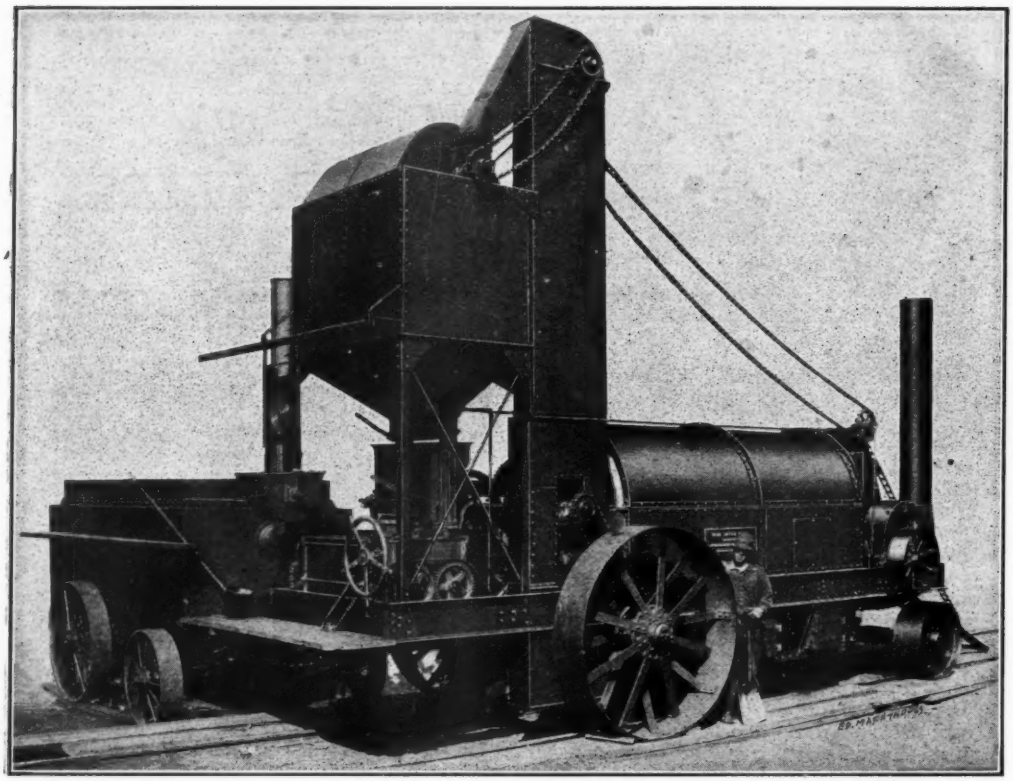
In the second place it is absolutely necessary that such a plant, in order to be worth while, must be capable of manufacturing not less than 500 square yards of finished pavement or road per day. No amount less than this can be handled with profit to the contractor.

In the asphalt paving business one square yard of sheet asphalt topping, 2 inches thick when compressed upon the street, has come to be generally accepted as the standard unit of measurement of plant capacities. The manufacture of sheet asphalt topping mixtures is the true test of capacity for a paving plant; mixtures for bituminous macadam and other like pavements are easier to make and can be turned out in greater quantities; consequently any plant which will turn out a given quantity of sheet asphalt mixture in a given time may be counted on for considerably greater output when other kinds of bituminous mixtures are being made.

During the past few years the efforts of manufacturers and inventors to produce a plant of this sort have resulted in the introduction of a machine com-



EARLY PORTABLE *Asphalt Paving Plant as made in* 1904.



PORTABLE ASPHALT MIXING PLANT *on trucks for use upon a street under improvement, the latest development in this line by Hetherington and Berner.*

monly known as a "hot mixer," which is not a regular paving plant, but is an expedient, and some engineers, on account of their opinion of the uncertainty of quantity and uniformity of its product insert a clause in their specifications for public work prohibiting that kind of a mixing machine. The capacity of the hot mixer is limited and uncertain, and it may therefore be unprofitable to the contractor.

Several other kinds of portable plants have been brought out within the past few years, but few if any of them have attained to any marked success.

The first illustration accompanying this article exhibits the beginning of the evolution of a portable road plant built by Hetherington & Berner. This first plant was built in 1904, and in July of the following year was used in the execution of a regular sheet asphalt paving contract in the city of Saginaw, Mich., and turned out material for more than 20,000 square yards of 1½-inch topping, going thru the job at the rate of 800 yards per day. It is still in use and has worked in many different places since that time.

Since the production of that first plant of this class the makers have redesigned and improved upon it many times, until they feel assured that in their latest model they have achieved finality in that direction and have produced a plant which is a close rival of the smaller railroad plants in the matter of capacity, and a plant that is first-class in every way and which can be sold at a price which ought to put it into the hands of contractors who have not been able hitherto to own a railroad plant.

This new plant has a working capacity of from 750 to 1,000 square yards of 2-inch sheet asphalt topping per day, is well built and operates with the minimum of labor. The main element of the success of this plant is the sand and stone heating drum. This is 5 feet in diameter and of an especial and new construction in the matters of the internal stirring and conveying devices, which has greatly increased the efficiency of this type of sand drum. The sand drum is mounted upon a frame or chassis made of steel struc-

tural material, and the chassis is carried by four steel built-up wheels, designed and built especially for the plant by Hetherington & Berner in their own shops.

The castings used in the construction of this new candidate for favor are made of steel in all parts where steel might have any superiority over good cast iron. The plant has embodied in its design several of the patented features of the Hetherington one-car railway plant, such, for instance, as the folding hot-sand elevator, the turn-down sand bin, etc. The hot-material storage bin is made with divisions which render it quickly adaptable for making mixtures for bituminous macadam pavements. The mixing machine is of sufficient size for an output of 1,000 square yards per day. The sand heating and mixing part of this plant constitutes one unit, complete in itself; other units consisting of one or more melting kettles mounted upon wheels operate in connection with the heating and mixing unit.

In one of the modifications of this portable plant an engine and boiler was added to the elements of the heating and mixing unit and this unit was made self-propelling, but experience demonstrated that the addition of the automobile or self-propelling feature was not advisable, because of the greatly increased weight and complication of mechanism.

As this outfit is now offered to the trade, driving power must be obtained from another source, either a portable steam engine, a gasoline motor or an electric motor. Inasmuch as a traction engine must necessarily form part of the equipment of a road-building contractor, it may be readily used for the purpose of supplying motive power for one of these road-making plants.

Clark's Traction Grader

A traction grader which excavates and conveys the material on the principle of the rear-end trench excavating machine is shown in the accompanying photograph. Its general design is seen clearly.

On the front end of the machine is a 20-h.p. horizontal boiler of the locomotive type, with a horizontal 20-h.p. reversible link motion engine rigidly bolted to the shell of the boiler. The driving mechanism is a system of pulleys and friction clutches, most of which is visible in the picture. It is so designed as to relieve the machine of shock and strain when large stones or other obstacles are run into.

At the rear is the bucket excavator and conveyor. The digging buckets are 3 feet long and 6 inches deep, and are equipped with detachable knives. Buckets are placed on the chain at proper distances to insure the most efficient work. The wearing edge of the buckets is drawn out to a knife-like edge. The chain operating the buckets, and to which they are attached, is designed to withstand the unusual strain to which it is subjected. It carries the buckets over two drums at the top, 3½ feet apart, and discharges their

CLARK'S TRACTION GRADER, *available for street grading, water and sewer trenching, old macadam separation, etc.*

contents on a conveyor which can be reversed so that it can deliver the excavated material to wagon on either side of the machine.

The buckets cut to the grade set at all times. The width of cut is 36 inches and the depth from 3 to 18 inches, and from 60 to 100 cubic yards can be excavated per hour.

The grader is self-propelling at 2 to 3 miles an hour. A complete compensating mechanism is employed, which allows it to turn round in a very small circle without undue strain on any part. When in operation, the machine will travel at the rate of 5 to 25 linear feet a minute, as the work requires.

The grader is 24 feet long, 8 feet wide and 11 feet high. Centers of front and rear wheels are 14 feet apart. Rear wheels are 54 inches diameter and 14 inches face. Pilot wheels are 36 inches and 12 inches. The total weight of the machine is 13,000 pounds.

It is claimed that the machine will do the work of 50 men at a saving of at least $80 a day.

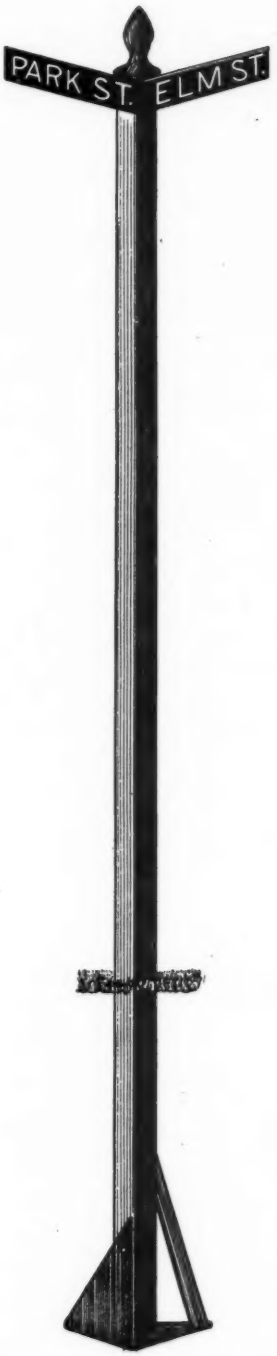
The machine can be transformed into a trenching machine to excavate 2 to 3 feet wide and 3 inches to 12 feet depth by substituting the necessary extra parts in the excavator and elevator end.

Joseph H. Clark, the inventor of the new machine, has been engaged in the work for many years and has designed other successful machines of the same general nature, on which the latest machine is claimed to be an improvement. The Utility Road and Farm Machinery Co., Chicago, Ill., manufacture the grader and will give full information concerning it.

Street Signs and Sign Posts

A very strong, durable and economical street sign post now on the market has a main standard of 2½ by 2½ by 3/16 inch angle iron, of the proper length to hold the signs 7 or 8 feet above the ground. Signs are attached in a very simple manner to a square iron casting, back to back in pairs, at right angles to each other, or in other words, a four-way sign, fastened together with brass bolts.

The posts are made for placing either in the ground in the parkway or on the cement sidewalks in the business districts. The parkway post is to be placed in the ground 30 inches. The bottom of the angle-iron post is first flattened and then turned at a right angle, so that the bottom end has a wide horizontal flange. To this is securely riveted a 3/16-inch plate 10 by 10 inches to set in the bottom of the post hole, above which concrete can be placed if deemed necessary to more



STREET SIGN POST *of angle iron as designed for use in parkways or lawns along the streets.*

securely hold the post in position. At the ground surface and extending 10 inches downward is another angle iron plate 10 by 4 x 4 by 3/16 inches, securely riveted to the main angle iron standard. This affords lateral resistance from four directions, and at the same time serves the purpose of giving double strength and double thickness at the point where there is the greatest strain on the post, and where the rusting and corroding takes place in all posts, just at the point where the air, water and earth come together.

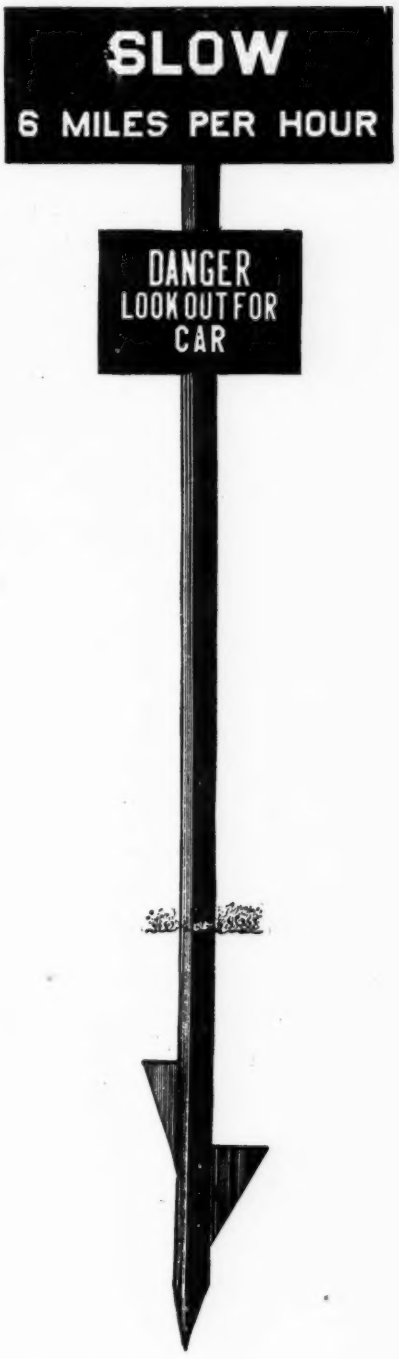
The post to be used in the business district has a heavy cast iron base extending 22 inches above the sidewalk, and this cast iron base is reinforced in the back by the angle-iron standard itself, which runs clear to the bottom of the post and is securely riveted to the iron casting, giving to the post very great strength at this point.

This angle iron post is made from old railroad rails re-rolled and will not break off when given a heavy blow, but will spring back to place. It does not have certain difficulties inherent in the gas pipe or hollow post. Thus a hollow post is constantly sweating on the inside, because of the difference between the temperature inside the post and outside. The wind and air cannot get at the inside of the post to dry it, neither can one get at the inside of the post to paint it; therefore the rusting process is constantly going on inside, while the outside may be kept painted and looking well. Then, too, the gas pipe is easily bent. The accompanying cuts show two designs for posts for use in parkways.

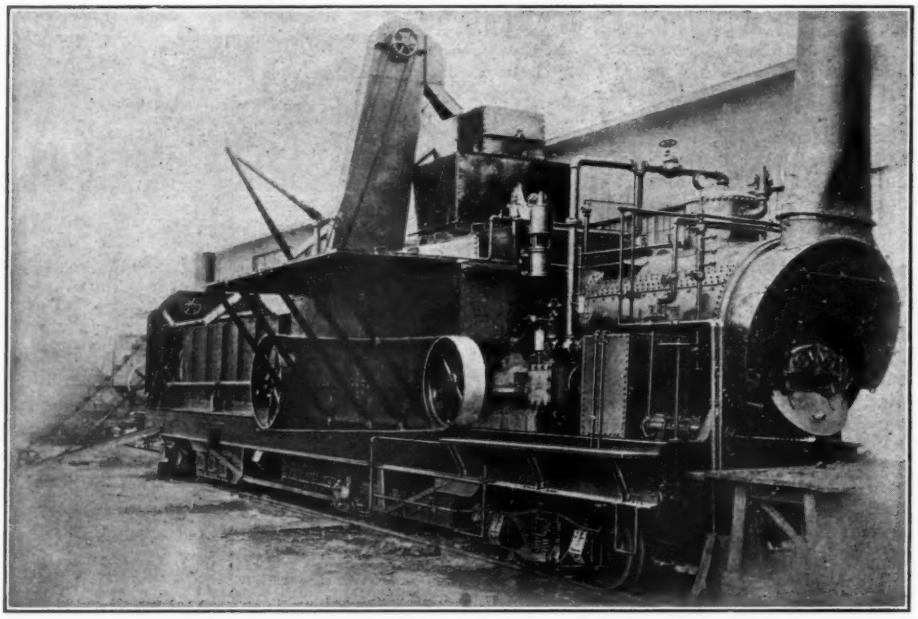
The enameled steel sign has demonstrated its value for use in naming streets. The signs are made by firing and fusing vitreous enamels into 18-gage steel or iron, under 2,000 degrees Fahrenheit; therefore they are guaranteed not to fade in any kind of weather. There is a glass surface finish, giving a luster that is attractive. They are more readable at night than any other sign not illuminated. European cities have used them for forty years and American cities for ten or fifteen years.

For street sign posts to go in the parkway, 30 inches in the ground and 7 or 8 feet above ground, making the post about 10 feet over all, without the signs, prices vary from $3.50 each in lots of 25 to $2.25 in lots of 200. For the same kind of post, except that it is made to set on the cement walk and fasten to the walk, with a heavy cast iron base and shorter than the parkway post, without the signs, the cost is from $4.50 in lots of 50 to $3.70 in lots of 200.

Another style of angle-iron post, lighter and for the parkway, and a 2-way sign only, is of 2 by 2 by 3/16 inch angles, and



STREET SIGN POST *of angle iron for permanent or temporary danger signs and other notices along roads and streets.*



ASPHALT PAVING PLANT *equipped for melting asphalt; on one railroad car, as designed by F. D. Cummer & Son.*

costs $1.90 in lots of 100 or $1.70 in lots of 200. This post has a different base and is now in use at Gary, Ind.

Brackets for attaching signs to trolley poles, electric light poles, etc., either wooden or iron poles, cost from $2 in lots of 25 to $1.50 in lots of 200, not including signs.

Steam Melting Asphalt Plant

Carelessness in handling plants melting asphalt by direct heat has been responsible for some failures in asphalt paving by burning the asphalt. There has been some discussion of this matter in recent communications to MUNICIPAL ENGINEERING, to which reference can be made for information. There are asphalt plants on the market which melt the asphalt by heat derived from steam pipes, in which it is practically impossible to burn the asphalt. One of the latest designs in this class is the Cummer one-car steam melting asphalt plant, which is shown in the accompanying photograph.

This plant is identical, except as to the melting end, with the Cummer direct-heat one-car asphalt plant of which about seventy-five are in use, some of them for the past ten years. The plant has a 125-h.p. Scotch horizontal internally-fired boiler. The two open asphalt kettles have a combined capacity of 1,450 cubic feet. They are 9 feet 6 inches long by 8 feet wide, with flat bottoms and almost continuous clean-out doors on both sides at the bottom. They are easily and thoroly agitated with air or steam. Each kettle has four sets of 1½-inch extra heavy continuous coils, so that the full capacity of the boiler can be used if desired, and a trap which keeps the coils free from condensed water and returns the condensation to the boiler. A kettle of asphalt is melted in four to six hours, depending on the kind of asphalt.

The 25-ton sand and stone dryer, 10-cubic-foot steam-jacketed mixer, 20-ton hot sand and stone storage bin, two cold material elevators, encased hot material elevator, engine, trucks, car frame, piping and other appurtenances are the same as on the well-known Cummer standard one-car plant.

To the Cummer patent sand drum is attributed the large capacity of the plant, 2,000 square yards of 2-inch top per ten-hour day or the equivalent in binder or asphaltic concrete of Topeka specification, and a 10-foot special mixer is used now instead of a 9-foot mixer, so as to take care of the drum output.

The F. D. Cummer & Son Co., Cleveland, O., will send full information about the new plant.

Fibre Conduit

The process of manufacture of Orangeburg fibre conduit is fully set forth in the third edition of the catalog of The Fibre

Conduit Co., Orangeburg, N. Y., which has recently been issued. The standard specifications contained in the catalog give the requirements that should be made of the conduit and of each of the types of joint used in putting the sections of conduit together. The various connections and specials are fully illustrated and dimensioned and tables of the characteristic dimensions of fittings for all sizes of pipe are given.

A good share of the catalog is taken up with statements of the advantages offered by the fibre conduit in the socket joint type, the sleeve, screw and Harrington joint types, small weight, handling, laying, rodding, water and acid resistance, prevention of electrolysis, mechanical strength, etc. There are also illustrations and brief descriptions of a number of installations of fibre conduit for various purposes, and of methods of construction of conduits, manholes, etc., and tables of costs of the same.

Acoustic Difficulties in Auditoriums Corrected

Since its erection in 1910, the Amasa Stone Memorial Chapel of Adelbert College has proved to be unsatisfactory acoustically. The general shape of the building, which is one of the Western Reserve University group in Cleveland, Ohio, is a long and narrow rectangle 140 feet by 30 feet, and experiments showed the difficulty to be due to general reverberation.

It was suggested that a sounding board be installed to eliminate this reverberation, and Prof. Frank P. Whitman, of the university, undertook a series of experiments to determine as accurately as possible just what benefit would be secured by this means.

Great care was taken to make the tests under conditions as nearly as possible like those of the ordinary use of the chapel, and involved the actual hearing of ordinary speech. The final comparative test was made first without and then with the use of the sounding board.

This board was of the horizontal type, generally considered most effective, hexagonal in shape, and 6 feet in diameter, surrounded by a vertical rim which extended 6 inches below the plane of the board. It was supported at a height of a little more than 2 feet above the head of the speaker.

Final results showed that the greatest benefit obtained by the use of the sounding board was to make the hearing 2 per cent. better in some parts of the building under certain conditions, while it actually made hearing less easy in the gallery.

Prof. Whitman showed that, for all practical purposes, the sounding board was useless.

The H. W. Johns-Manville Co. was then asked to undertake the correction of the chapel by its system based on the scientific researches of Prof. Wallace C. Sabine, of Harvard University. J-M acoustical treatment was applied to the ceiling panels and upper walls, and resulted in the elimination of all the acoustical defects.

CHAPEL OF ADELBERT COLLEGE, *acoustic defects of which have been corrected by treatment of ceiling panels and upper walls.*

AUTOMOBILE TRUCKS *for commissary Departments of European armies. The third shipment of like size since October 1 made by the Kissel Motor Car Company.*

The accompanying photograph shows the interior of this chapel which must stand as a monument to the remarkable success to be obtained by this method of treatment.

KisselKar Tractor on Hook and Ladder Truck

At a recent firemans' tournament, held at Riverhead, L. I., a new hook and ladder tractor recently placed in service by the municipality of Patchogue, L. I., attracted great attention and comment. The front wheels of the old horse-drawn truck had been taken off and the tender attached to a sturdy 1½-ton KisselKar chassis. It was pronounced a very handsome job and is said to be giving remarkably efficient service. It is the only motor-driven fire department tractor on Long Island.

Trade Notes

Among the contracts awarded to the Raymond Concrete Pile Co. are concrete piles in the foundations of the North Hill School, Burlington, Ia.; foundation of Wayne street viaduct, Butler, Pa.; foundation of a building to be erected as a memorial to women of the Civil War, Washington, D. C.

The MacArthur Concrete Pile & Foundation Company has sold the patent rights to drive the pedestal pile in Japan to the Oriental Compressol Company of Tokio, Japan, and has appointed Douglas-Milligan Company as their sales agents for Eastern Canada, with main office in the New Birks building, Montreal, and branch office at 95 King street East, Toronto.

The Alliance City Clay Product Company of Alliance, Ohio, is the latest acquisition to the family of licensees of the Dunn Wire-Cut-Lug Brick Co., of Conneaut, Ohio. Others who have joined recently are Springfield Paving Brick Co., Springfield, Ill.; Terre Haute Vitrified Brick Co., Terre Haute, Ind., and Albion Vitrified Brick Co., Albion, Ill.

Floyd F. Woods has been appointed sales manager for the Epping-Carpenter Pump Co. of Pittsburg, Pa. Mr. Woods takes the place of R. Bowen, who is no longer connected with the company.

Trade Publications

The world's greatest asphalt plant, that of the Barber Asphalt Paving Company at Maurer, N. J., is described in a well-illustrated booklet issued by the company, which can be obtained on application to the Philadelphia office.

The Thomas B. Jeffrey Company, Kenosha, Wis., issues a fully-illustrated reminder of the Jeffrey dealers' convention, devoted especially to the Jeffrey Quad truck and the new automobile models.

The Western dump wagon is the subject of a circular of the Western Wheeled Scraper Company, Aurora, Ill.

The subject of a recent booklet of the De la Vergne Machine Company, 1165 E. 138th street, New York City, is "The Easiest Profits," showing the low cost of the De la Vergne oil engine power plant in comparison with motor-driven and steam power plants, the ratio of expense of a 100-h.p. engine running ten hours being as $1.88 for oil, to $7.00 for steam and $15.00 for electric current.

Aztec road surfacing asphalt for worn-out and ravelled macadam roads is the subject of a recent booklet of The United States Asphalt Refining Co., 90 West St., New York City.

The Bulletin of the Universal Portland Cement Company for October has a list of illustrated articles on uses of cement well distributed over the whole field of roads, bridges, warehouses, water towers, etc.